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Reconnaissance Report  
Local Study Cost Sharing Agreement  
Shore Protection And Erosion Control Project

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# **Nantasket Beach Shore Protection Study Hull, Massachusetts**



**US Army Corps  
of Engineers**  
New England Division

August 1993

SECTION 103  
SHORE PROTECTION AND EROSION CONTROL  
RECONNAISSANCE REPORT

NANTASKET BEACH  
HULL, MASSACHUSETTS

1993  
U.S. ARMY  
CORPS OF ENGINEERS  
NEW ENGLAND DIVISION

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.</small>				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE August 1993	3. REPORT TYPE AND DATES COVERED Final Report		
4. TITLE AND SUBTITLE  Nantasket Beach Shore Protection Study, Hull, MA Reconnaissance Report		5. FUNDING NUMBERS		
6. AUTHOR(S)  William Coleman, et al		8. PERFORMING ORGANIZATION REPORT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Corps of Engineers New England Division 424 Trapelo Road Waltham, MA 02254-9149		10. SPONSORING / MONITORING AGENCY REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Corps of Engineers New England Division 424 Trapelo Road Waltham, MA 02254-9149				
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT  Approval for public release; distribution is unlimited.		12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words)  This shore protection and erosion control study was conducted by the New England Division, U.S. Army Corps of Engineers at the request of the Metropolitan District Commission. The study was funded under the continuing authority provided by the Corps of Engineers' Section 103 of the 1962 Rivers and Harbors Act, as amended for the purposes of shore protection and flood damage reduction from coastal storms. The Reconnaissance Report demonstrates that a sandfill protection plan at Nantasket Beach is environmentally, economically, and technically feasible and concludes that further planning to alleviate shore damages and flooding are in the the Federal interest.				
14. SUBJECT TERMS  Nantasket Beach; Hull, MA; Shore Protection		15. NUMBER OF PAGES 153		
		16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT  Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE  Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT  Unclassified	20. LIMITATION OF ABSTRACT	

## EXECUTIVE SUMMARY

This report was prepared by the New England Division, Corps of Engineers at the request of the Metropolitan District Commission (MDC). During the "Halloween Storm" of October 30-31, 1991, the concrete seawalls along the MDC Nantasket Beach Reservation in Hull, Massachusetts, experienced a substantial amount of damage and undermining. In addition, a large volume of beach material seaward of the walls was also lost. The critical nature of the situation prompted the MDC to write a letter to the Corps on January 6, 1992 requesting assistance in protecting the seawalls and backshore from future storm damage and flooding.

Significant storm damage to the concrete seawalls, riprap, stairs, ramps, walkouts and sidewalks along with backshore flooding from waves overtopping the walls, as described in the Hydrologic and Hydraulics Appendix D, has occurred in the past and will continue in the future if no protective measures are taken. The most severe damage in recent times occurred during the northeast storms of October 30-31, 1991 and December 11-12, 1992 when a 400 foot section of the concrete seawall tipped over. It is estimated that these two events together caused almost \$2,500,000 in damages to the MDC facilities and another \$150,000 or more to the backshore.

Nantasket Beach is part of a narrow sand spit formed from eroded glacial sediments which extends in a NW-SE direction from the bedrock mainland in the town of Hull. The study area is approximately 6,800 feet in length and lies at the southerly end of the spit just north of Atlantic Hill. The beach faces the open Atlantic Ocean to the northeast and is backed by concrete seawalls and riprap, which immediately protect backshore parking areas, a pavilion and a bath house. Further back and parallel to the seawall and beach are Nantasket Avenue and Hull Shore Drive, which front approximately 55 commercial, 26 residential buildings and a sanitary facility in the 100-year flood plain. At the north end of the study area, the seawall and riprap protect Nantasket Avenue, where the road provides the sole access between the mainland and the northern two-thirds of the Town of Hull's land area and its population. With its immediate exposure to the Atlantic Ocean and its proximity to the urban areas of greater Boston, the study area exhibits a very heavy summer population and an increasing year round population. Use of the beach and adjacent backshore facilities is very intensive in the summer. (See Location Map - Figure 1 in this report).

This report describes the problem and its effects on the MDC Nantasket Beach Reservation and the town of Hull and discusses several alternative solutions designed to reduce shore damage and backshore flooding. The protection plan proposed in this Reconnaissance Report for further study provides for the construction of a beach fill project with a 75 foot wide level beach berm at elevation 17 feet above mean low water (mlw) extending seaward from the concrete seawall with a fronting slope of 1 vertical to 15 horizontal that extends downward until it intersects the existing ground. It is anticipated



that the beach fill will be obtained from a land-based borrow site within a 35 mile radius of the beach and that will have a median grain size of about twice the native material to increase its stability against erosive forces.

Preliminary field investigations, as well as initial coordination with Federal, State and local resource agencies, have not revealed any outstanding or unreasonable environmental issues or concerns. A draft cost sharing agreement between the U.S. Army Corps of Engineers and the local sponsor, the Metropolitan District Commission, for the feasibility phase of the study is included. The tasks to be performed during the course of the study are described and the cost for each area detailed.

The total scheduled construction costs of the plan put forward in this report is \$4,220,000 and the total annual charges, consisting of interest and amortization of the first costs and the cost of periodic sand nourishment, based on historic records, is \$383,000. Average annual benefits from damages prevented are estimated at \$2,737,200. The benefit-cost ratio is 7.1.

The overall financed cost of the project is summarized as follows:

	<u>Federal</u>	<u>Non-Federal</u>	<u>Total</u>
Scheduled Construction Cost	\$1,775,000	\$2,445,000	\$4,220,000
Study Cost			
(Reconnaissance & Feasibility)	225,000	100,000	\$325,000
Unscheduled Construction Cost			
(Nourishment)	<u>-0-</u>	<u>1,370,000</u>	<u>1,370,000</u>
TOTALS	\$2,000,000	\$3,915,000	\$5,915,000

The reconnaissance study described in this report demonstrates that the project is environmentally, economically and technically feasible and concludes that further planning studies to alleviate shore damage and flooding are in the Federal interest.

The non-Federal sponsor, the Metropolitan District Commission, strongly supports the project, as noted in their June 8, 1993 letter contained in Appendix B.

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HULL, MASSACHUSETTS  
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RECONNAISSANCE REPORT

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INTRODUCTION

The Nantasket Beach study area consists of the Metropolitan District Commission's (MDC) Nantasket Beach Reservation and the adjoining backshore area that lies in the town of Hull, Plymouth County, Massachusetts. The study area includes the first 6,800 feet of a 17,000 foot elongated spit extending along a NW-SE axis into Massachusetts Bay from Atlantic Hill on the south to Point Allerton on the north. (See Location Map - Figure 1). The study has focused on measures to reduce future damaging effects of wave and tidal action on the existing concrete seawalls and backshore flooding during periods of wave overtopping.

Nantasket Beach's location on the Atlantic Ocean and close proximity to the urban areas of greater Boston, cause it to have a substantial increase in population during the summer months. Use of the beach area and adjacent land is very intensive in the summer.

Wind driven waves from the east have caused extensive loss of beach material in front of the concrete seawalls. In turn, this has left the walls vulnerable to damage and undermining caused by wave and tidal action and has increased the amount of interior flooding during periods of wave overtopping, as defined in the Hydrologic and Hydraulics Appendix D.

This Reconnaissance Report presents the results of the investigations that were conducted to determine the feasibility of providing local shore and flood protection to the area that were undertaken at the request of the MDC in their letter of January 6, 1992.

AUTHORITY

This report was prepared under the special continuing authority of Section 103 of the 1962 Rivers and Harbors Act, as amended, for the purposes of shore protection and flood damage reduction from coastal storms.

STUDY PURPOSE AND SCOPE

The purpose of this reconnaissance study is to determine whether further planning to alleviate the storm damages in the study area is in the Federal interest.

Most past damages, especially in the recent past, have occurred to the existing concrete seawalls including the ramps, stairs, walkouts, riprap and sidewalks as well as backshore flooding due to

wave action and overtopping. This study reexamines previous study findings in this area, especially the previously authorized sand fill project, and on a reconnaissance level of detail, examines the entire width of the spit in the study area with respect to shore damage and flood reduction. (See Appendix D).

Damages that would occur in the study area if no project was constructed have been estimated, based on information supplied by the MDC and stage frequency curves prepared by the New England Division (NED) for the back shore area. Several potential improvement alternative plans to alleviate damages to the backshore structures were considered and one was examined in sufficient detail to provide a preliminary cost-benefit analysis. An environmental review for the area was performed.

#### PRIOR STUDIES AND REPORTS

Cooperative beach erosion control studies at Nantasket Beach have been made previously with the Metropolitan District Commission. The first report by the Division Engineer on Nantasket Beach was submitted to the Chief of Engineers on June 1, 1949. The report stated that Nantasket Beach was stable and recommended that the problem of maintenance of the beach for recreational use be accomplished by local interests entirely at their own expense by burying and covering stone deposits or by removal of stones and replacing them with equal volumes of sand.

The second report by the Division Engineer on Nantasket Beach was submitted to the Chief of Engineers in March 1968. The report concluded that the most practical and economical method of protection and restoration of the beach is to provide for beach widening by placement of suitable sand fill along about 6,800 feet of beach fronting the Metropolitan District Commission Reservation to a general backshore elevation of 17 feet above mean low water, thus furnishing a recreational and protective beach width averaging 190 feet behind the mean high water line. The project was subsequently authorized by Congress in December 1970. However, due to a lack of local cooperation, the project was never constructed and it was subsequently de-authorized in January 1990.

In addition to these Corps reports, a report entitled "Evaluation of Coastal Protection Measures at Nantasket in Hull, Massachusetts, Volumes 1 and 2, was prepared for the Disaster Recovery Team, Commonwealth of Massachusetts, by the Water Resources Division, Environmental Planning Division, Camp Dresser and McKee, Inc. (CDM), June 30, 1980. This report summarizes damages from the February 1978 blizzard to both the study area and North Nantasket Beach. Most of the report focuses on the residential area located north of the study area. The CDM report discussed the type of damages incurred from the storm, the damage costs, and recommended some measures for coastal protection from overtopping at the north end of the spit. It did not recommend any measures for coastal protection for the MDC reservation area.





FIGURE 1



## PHYSICAL SETTING

Nantasket Beach is located in the town of Hull, Plymouth County, Massachusetts, about 4 miles southeast of the main entrance to Boston Harbor and 12 miles southeast of the City of Boston. The MDC reservation is on the northeast side of a narrow tombolo formed when, following the most recent glaciation in the region, a spit tied the bedrock of the Atlantic Hill section of Hull to several drumlins such as Strawberry Hill and Allerton Hill. The entire spit is 17,000 feet in length with the study area comprising the southerly 6,800 feet and North Nantasket Beach the northerly 10,000 feet. The tombolo is 500 feet wide in the study area. The spit faces the Atlantic Ocean to the northeast and encloses Hull Bay on the southwest.

The sand comprising the present spit was derived from marine erosion of several drumlins in the area, many of which have been completely worn away. The several drumlins still existing are protected in a variety of ways from marine erosion, thus prohibiting any significant future natural replenishment of sand to the spit.

Analysis of shoreline change maps along the entire length of the spit shows the position of the mean high water line (MHW) to have both advanced and retreated over the period of record. According to the 1968 Corps of Engineers report cited previously there has been no significant net change in the position of the MHW over the past century. The 1968 report does not, however, relate the position of the MHW to sea level rise which is estimated at one foot over the past 100 years, and which is assumed to continue at least at the same rate for the next several decades.

Beach profiles reveal slopes that vary from 1:10 at the seawalls to flat slopes of 1:30 to 1:90 below the MHW in the study area. The beach is composed of light brown fine sand. The median grain size is about 0.25 mm with cobbles present on the backshore near the wall. The mean tidal range is 9.4 feet. Mean low water is 4.5 feet lower than NGVD.

The alignment of the spit is such that the dominant high energy waves from the northeast strike the beach with little or no long shore transport component. The nature of this alignment, the general morphology of the area and field observation strongly suggest that there is little net littoral drift occurring in the area.

The observations stated above as well as the position of the parallel offshore contours to the 30 foot depth contour approximately 3,000 feet offshore, indicate a relatively stable area extending from the backshore 3,000 feet out to sea and extending along the entire length of the spit. Within this cell typical seasonal changes will occur but there will be little overall net natural erosion or accretion under normal circumstances.

Removal of stones and cobbles from the beach by town and state agencies may have contributed to some net lowering of the beach as reported in the 1968 Corps of Engineers report. Storms, usually occurring in the winter season, carry fine materials out to sea from the beach leaving behind a lag deposit of stones and pebbles. These are most evident in late winter and early spring. In order to "improve" the beach from a recreational standpoint a program of large scale removal of the stones and cobbles was initiated in the 1950's. A consultant to the MDC recommended in 1973 that similar stone be restored to the beach and that sufficient sand fill be placed in order to bring the beach back to the pre-cobble removal condition. The 1968 Corps of Engineers report concluded that lack of a sand source for natural replenishment together with the manual removal of material from the beach are factors which contributed to the loss of recreational beach at high tide in the study area.

#### PROBLEM DEFINITION

With the continuing loss of sand fill in front of the concrete seawalls and substantial lowering of the beach elevation the walls are now experiencing significant damage and undermining due to wave and tidal action. Overtopping of the walls and flooding of the backshore is now occurring with greater frequency during less intense storms than was the case in the past. Several sections of the concrete wall have already toppled over. If no alternative solutions are found to protect the concrete walls and reduce the overtopping and backshore flooding, the possibility exists that the walls will be lost completely along with the backshore roadway and a breach may ultimately occur in the spit at the northern portion of the study area thus isolating about two-thirds of the town on Hull's land area and its population from the mainland.

#### ENVIRONMENTAL SETTING AND RESOURCES

The beach in front of the seawall and riprap in the area of the MDC reservation is composed of light sand with pockets of cobbles located up against the concrete walls. The seawalls and riprap protect a public area located immediately behind the seawalls consisting of parking areas, a bathhouse, and a pavilion. Further back are Hull Shore Drive and Nantasket Avenue. Nantasket Avenue provides the sole access to the northern two-thirds of Hull's land area and its population. The backshore is composed of small seasonal commercial businesses such as: restaurants, an arcade, souvenir shops, a grocery store, a hardware store, as well as single family residences and a large apartment building at the south end.

The area is designated as a public beach according to the Massachusetts Coastal Zone Management Plan (CZM 1977). An intertidal sand flat is located directly offshore from the beach. No dunes or seagrasses were observed in the project area during the most recent site visit conducted on March 4, 1993.



As a result of the lack of sand in the backshore area, the upper beach areas are currently unstable and are mostly underwater during the higher portions of the tidal cycle. These shifting sands provide little, if any, suitable substrate for biota to colonize. No dunes or seagrasses or significant environmental resources were observed within the intertidal area during a cursory site inspection. However, no formal biological sampling program has yet been carried out.

Numerous fragments of surf clams were observed within the beach area. Initial coordination has revealed that subtidally, a commercially harvestable surf clam population exists offshore. Lobsters are also harvested in the offshore waters.

#### PLAN FORMULATION

Water resources planning undertaken by Federal agencies is directed by the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. The economic and environmental principles contained in these guidelines relative to plan formulation were followed in this report so as to adhere to the Federal objective of contributing to the National Economic Development consistent with protecting the National environment. Various alternative plans were formulated in a systematic manner with a view toward enhancing national economic development and protecting environmental quality. Each of the several plans formulated were evaluated taking into consideration the four criteria of completeness, effectiveness, efficiency and acceptability.

#### STATEMENT OF PROBLEM

A significant amount of damage and undermining is being experienced by the concrete seawall and riprap that fronts the MDC Reservation due to wave and tidal action. During the recent past this situation has worsened due to the substantial loss of beach material and the lowering of the beach elevation in front of the seawall. The loss of beach material in turn has increased the amount and frequency of wave overtopping and backshore flooding. This shore damage and flooding is expected to continue and intensify in the future if no protective measures are taken. This section of the report will offer evidence in support of this problem statement, will describe the magnitude of the problem, and will discuss possible alternative proposals to alleviate the problem.

#### WITHOUT PROJECT CONDITION

Since the early 1970's, the backshore concrete seawalls, ramps, stairs, walkouts, riprap and sidewalks along the MDC reservation have been experiencing a gradual deterioration due to wave and tidal action, weathering, and abrasion. This situation has worsened during the past few years as a result of the increased erosion of beach

material in front of the seawall with the subsequent lowering of the beach elevation. The absence of any structured maintenance and repair program by the MDC over this time period has further contributed to the severity of the problem.

As a result, the area was very vulnerable at the time the "Halloween Storm" of October 30-31, 1991 occurred. The storm caused a substantial amount of structural damage to the concrete walls, ramps, stairs and riprap along with the erosion of a large volume of beach material. Approximately 350 feet of the wall experienced undermining and 370 feet of the wall was determined to be in need of replacement. At the time, the MDC estimated that about \$1,100,000 in immediate structural repairs were needed.

Due to the extensive undermining and damage that occurred to the seawalls and erosion of beach material, the MDC, in a letter dated January 6, 1992, requested the New England Division to reactivate the previously authorized project. However, based on the critical nature of the situation, a decision was made to conduct this Reconnaissance Study under the authority contained in the Section 103 of the 1946 Flood Control Act, as amended, that is administered under the Corps Continuing Authorities Program.

Since the time of their letter, the MDC has not been able to put out a contract to make the immediate repairs that were needed. Subsequently, on December 11-12, 1992 another northeast storm hit the area and a 400 foot section of the concrete seawall at the north end of the beach tipped over. Emergency repairs have been made at a cost of about \$1,000,000.

During both the October 1991 and December 1992 storms, the walls were overtopped and the backshore roadways were flooded. Some minor flooding also occurred to the backshore commercial establishments. However, for the most part the flood waters just ran down the roadways and emptied into the Bay without causing any substantial damage.

If permanent repairs and protection measures are not implemented very soon, the backshore facilities and roadway are in danger of being lost. If the situation is allowed to continue, it may ultimately result in a breach in the spit that could cutoff the northern portion from the mainland.

For this study, the project area has been broken down into two damage areas. The first includes all the land, structures and facilities within the MDC Nantasket Beach Reservation including the beach itself. The second includes the backshore roadways, private residents and commercial structures. The backshore has been further divided into three damage zones as shown on Plate D-2 in Appendix D. Those zones are defined by street elevations and temporary ponding areas noted during a site visit during the December 1992 storm. It is believed that each zone acts independently to convey flood waters into the bay area.

The MDC has provided information relative to the cost of past damages that have occurred and an estimate of the cost of future damages that may occur if no permanent protection measures are implemented. This information was used to estimate the annual damages that would be prevented in the MDC reservation with a protection project in place. The details are shown in the Economic Justification Section of this report.

For the backshore damage zones 1, 2, and 3, a preliminary analysis has shown it is possible to design a protection project that will substantially reduce backshore flooding for storms up to a fifty year event. This determination is based on comparing the wave runup and overtopping that is occurring along the existing beach with that which would be experienced with a protection project in place. Stage frequency curves developed for interior flooding due to wave overtopping are contained in Appendix D.

In order to determine the top of runup and volume of overtopping that is currently occurring along the Nantasket Beach and that which would occur with a protection project in place, it was necessary to establish design parameters needed to compute wave heights and periods for various storm events.

Wind data from Logan Airport in Boston, that was presented in the General Design memorandum, Revere Beach Erosion Control Project, August 1985 (revised June 1986), was assumed to be applicable to the study area. The National Weather Service (NWS) has recorded 31 years of hourly one-minute average windspeed and direction data at Logan Airport from 1945 through 1979. A duration of 24 hours was selected for winds from the east-northeast having return periods of 2, 5, 10, 25, 50 and 100 years blowing over a fetch length of 400 miles during periods of fully developed seas. The design wave heights and periods that were calculated using these parameters are shown in Table 1.

TABLE 1  
WIND GENERATED WAVES  
NANTASKET BEACH, HULL, MASSACHUSETTS

Return Period (Yrs)	Duration (Hrs)	Wind Speed (MPH)	Fetch (MI)	Wave Height (Ft)	Wave Period (Sec)
100	24	39	400	24.1	14.3
50	24	37	400	22.2	13.7
25	24	34	400	19.4	12.8
10	24	29	400	15.2	11.3
5	24	27	400	13.6	10.7
2	24	21	400	6.6	7.5

On December 16, 1992, nine beach profiles were surveyed along 6,000 feet of Nantasket Beach and nine reaches were established for use in calculating existing overtopping volumes. (See Appendix D). A nearshore slope of 1 vertical to 50 horizontal was assumed, and wave heights for the various return periods noted above were adjusted for the wave to break at the toe of the structure. The results indicated that no overtopping would be experienced along the first 1200 feet at the north end of the beach or for about the first 350 feet at the south end for any of the return periods considered. However, all along the middle 5300 feet of beach, a fairly significant amount of overtopping is being experienced during the five year event and increases substantially as the intensity of the storms increase. The top of runup was calculated to be about twice as high as the top of the walls during the 100 year storm event. The following Table 2 shows this information in tabular form.

TABLE 2  
EXISTING RUNUP AND OVERTOPPING CONDITIONS ALONG THE  
MIDDLE 5300 FEET OF NANTASKET BEACH

Return Period (Years)	Average Top of Wave Runup (feet above NGVD)	Average Height of Top of Wall (feet above NGVD)	Average Rate of Overtopping (CFS)
100	33.6	16.2	4900
50	31.6	16.2	4200
25	28.7	16.2	3200
10	24.2	16.2	1400
5	22.4	16.2	900
2	16.8	16.2	100

A similar set of calculations were made with a protection project in place. The results are shown in Table 3 in the Economic Justification Section of this report, along with a summary of the effectiveness of a protection project in reducing overtopping and backshore flooding as defined by the stage frequency curves shown in Appendix D.

#### SCREENING OF ALTERNATIVES

Measures addressing coastal shore/flood damage reduction fall into two general categories. Some modify the extent of shore damage/flooding by altering the natural environment; such as breakwaters, seawalls, revetments, etc. Others address shore/flood damage vulnerability through flood plain regulations, flood insurances, and flood proofing.

## ALTERNATIVE/SHORE/FLOOD DAMAGE PREVENTION MEASURES

### MODIFYING SHORE DAMAGE/FLOODING

Breakwaters  
Revetments  
Beach Restoration  
Groins

### REDUCE VULNERABILITY

Floodproofing  
Flood Warning and Evacuation  
Flood Insurance

Below is a brief description and a summary of the study's findings for each type of measures investigated for Nantasket Beach.

#### Breakwaters

A breakwater is a structure that can serve to protect a shore area, harbor, anchorage or basin from wave attack. Beaches and flood prone areas along the coast can be protected by a structure that reduces the wave energy reaching the shore. Breakwaters are generally some variation of an offshore rubble stone mound structure, adaptable to almost any depth and can be exposed to severe waves.

Breakwaters can have both beneficial and detrimental effects on the shore. Offshore breakwaters are usually more costly than onshore structures, such as seawalls or revetments. The elimination of wave action not only provides protection but also reduces the movement of sand along the shore and thereby prevents the nourishment of the downdrift beaches.

The cost of a breakwater located offshore was found to be prohibitive, with an estimated cost far in excess of benefits to be derived. It was therefore dropped from further consideration in this study.

#### Revetments

Sloping revetments armor the seaward face of a shoreline with one or more layers of stone or concrete. This sloping protection dissipates wave energy, with a less damaging effect on the shore. Two types of structural revetments are used for coastal protection: the rigid, cast-in-place concrete type and the stone armor unit type.

On the negative side, revetments will displace the beach in front of the seawalls which is contrary to one of the study's objectives of protecting the values and qualities of the area's seaside location.

Like the breakwater, the cost of a revetment was found to be prohibitive, with estimated costs far in excess of benefits to be derived. Accordingly, it too was dropped from further consideration in the reconnaissance study.

## Beach Restoration and Nourishment

Beaches are very effective in dissipating wave energy. When maintained to adequate design dimensions, they can afford protection for the adjoining backshore. When conditions are suitable, long reaches of shore may be protected by artificial nourishment. The resultant widened beach also has added value as a recreational feature.

This measure will be evaluated in more detail in subsequent pages of this report.

## Groins

Groin structures are shore protection structures usually built perpendicular to the shoreline to trap longshore littoral drift or retard erosion of the shore. They can also be used in conjunction with artificial sand fill to compartmentalize the sand and keep it in place. The alignment of the shoreline at Nantasket Beach is such that the waves approach almost perpendicular to the shore and a majority of the sand losses are directly offshore. The use of groin structures at Nantasket Beach is not considered to be a viable method of trapping material or retarding erosion along the beach. It is therefore not going to be given any further consideration in this study.

## Floodproofing

This encompasses several techniques for preventing damages due to floods, requiring action both to structures and to building contents. It involves keeping water out, as well as reducing the effects of its entry. Such adjustments can be applied by the individual, or as part of a collective action, either when buildings are under construction or during remodelling.

Floodproofing, like other methods of preventing flood damages, has its limitations. It can generate a false sense of security and discourage the development of needed flood control and other actions. Indiscriminately used, it can tend to increase uneconomical use of flood plains.

Floodproofing measures can be classified into three broad categories. First are permanent measures which become an integral part of the structure or land surrounding it. Second are temporary or standby measures which are used only during floods, both which are constructed and made ready prior to any flood threat. Third are emergency measures which are carried out during flood situations in accordance with a predetermined plan. In recent years, floodproofing has come to be known as a "nonstructural" measure. Structural measures are traditionally associated with major civil flood control works.

Typical nonstructural measures include closure for openings (doors, window, etc.), waterproof sealants for walls and floors, utility valves to prevent backflow of sewer and plumbing facilities, and sump pumps. Another technique is raising existing structures above design flood levels.

Within an existing group of structures, damageable property can often be placed in a less vulnerable location or protected in-place. Furnaces and appliances can be protected by raising them off the floor. Damageable property can be moved from lower to higher floors, or other less flood prone sites. Important mechanical and/or electrical equipment can be floodproofed by enclosing them in a watertight utility cell or room.

A consideration that must be included is that residual damage to both the structure and contents will remain even when the most vulnerable property is rearranged or protected. Measures such as these are usually considered when other measures are either not physically or economically feasible, or the depth of flood is relatively shallow.

Elimination of flood damages can also be accomplished by relocation of existing floodprone structures and/or contents. There are basically two options for removing property to a location outside the flood hazard area. One is to remove both structure and contents to a flood-free site; the second is to remove only the contents to a structure located outside the flood hazard area, and demolish or reuse the structure at the existing site.

A number of the above mentioned flood proofing measures have already been implemented by the owners of the backshore structures. They have proved effective during lesser storm events when flooding is kept below the first floor level. Floodproofing by itself does not provide a comprehensive solution that is acceptable to the public. Much of the loss that has been experienced in the project area has been as a result of damage to the seawall and appurtenant facilities. These structures cannot be floodproofed. Accordingly, floodproofing has not been selected for any further detailed evaluation.

#### Flood Warning and Evacuation

Flood forecasts, warning and evacuation is a strategy to reduce flood losses by charting out a plan of action to respond to a flood threat. The strategy should include:

- A system for early recognition and evaluation of potential floods.
- Procedures for issuance and dissemination of a flood warning.

- Arrangements for temporary evacuation of people and property.
- Provisions for installation of temporary protective measures.
- A means to maintain vital services.
- A plan for post flood reoccupation and economic recovery of the flooded area.

Flood warning is the critical link between forecast and response. An effective warning process will communicate the current and projected flood threat, reach all persons affected, account for the activities of the community at the time of the threat (day, night, weekday, weekend) and motivate persons to action. The decision to warn must be made by responsible agencies and officials in a competent manner to maintain the credibility of future warnings.

An effective warning needs to be followed by an effective response. This means prompt and orderly evacuation and/or action.

This includes:

- Establishment of rescue, medical and fire squads.
- Identification of rescue and emergency equipment.
- Identification of priorities for evacuation.
- Surveillance of evacuation to insure safety and protect property.

The town of Hull does not have a structured flood warning and evacuation plan. However, prior to and during severe storm events, the town officials alert the residents on the local cable station. They are provided with general guidance as to necessary actions they should take and places they could evacuate to if necessary.

The town should consider developing a formal flood warning and evacuation plan to include the following:

- Development of a flood warning system.
- Determination of safe evacuation routes.
- Provisions of adequate emergency shelters.
- Methods to provide vital services.



However, warning and evacuation alone do not prevent widespread flooding and the physical damage it brings. Accordingly, flood warning and evacuation has not been selected for any further detailed evaluation in this report.

### Flood Insurance

Flood insurance is not really a flood damage reduction measure: rather it provides protection from financial loss suffered during a flood. The National Flood Insurance Program was created by Congress in an attempt to reduce, through more careful planning, annual flood losses and to make flood insurance protection available to property owners.

The program provides local officials with a usable tool in protection of their flood plains. A flood-prone community, once on the regular program, must enact flood plain zoning in accordance with minimum guidelines established by the Federal Emergency Management Agency (FEMA). Hull is such a community and they have adopted appropriate flood plain zoning regulations.

Without implementation of a flood damage reduction system, the financial losses associated with flooding will continually be a burden. It is not economical, nor wise for the government, both State and Federal, to continually provide assistance. Personal assets are limited. Like other flood plain regulations, use of flood insurance is encouraged. However, it also does not reduce the physical damage and social disruption caused by a flood. Since all new development would be required to elevate at or above the base flood (an event having a 1 percent chance of occurrence annually), and because of the extent of existing development, further study of flood insurance is not appropriate.

### Sand Fill Protection Project

Based on preliminary studies accomplished in the reconnaissance phase the protection project involving placement of sand fill along approximately 6,800 feet of beach fronting the MDC reservation to a general backshore elevation of 17 feet above mean low water has been determined to be cost effective and warrants more detailed evaluation in the Feasibility Study Phase.

Starting at the seawall the project would provide for a 75 foot wide level beach berm at elevation 17 feet above mean low water. From here the beach face would then slope seaward with a slope of 1 vertical (V) to 15 horizontal (H) until it intersects the existing ground. This would then provide a protective beach averaging 190 feet in width behind the mean high water line (see plates 1-10).

Based on existing conditions, some sections of the seawall along the middle portion of the beach are experiencing overtopping during storm events that occur as often as every two years. The amount of overtopping increases substantially during more intense storm events with return periods between 5 to 100 years. (See Appendix D).

With the beach fill project in place, the waves will break farther offshore and runup the face of the beach. The berm elevation of 17 feet above mlw will not be overtopped by storm waves having a 50 year return frequency or less. During more intense storm with return frequencies of up to 100 years, if the beach is in place and at its full design dimensions, overtopping of the backshore wall will be substantially reduced. (See Appendix D). However, if the storm continues in intensity over several tide cycles and the beach erodes back to any significant extent, the amount of overtopping will increase accordingly.

Topographic surveys and profiles conducted as part of the reconnaissance study were used as the basis to estimate volumes of sandfill necessary to construct the beach to the proposed design dimensions noted above. Survey measurements show that 465,000 cubic yards of sand are necessary for the protective beach. A preliminary material source survey has shown that suitable beach fill can be obtained from a land-based borrow pit within a 35 mile radius of the beach. Based on a recent experience with the sand fill at Revere Beach it is anticipated the material will have a median diameter of between 0.4 to 0.5 mm which is about twice that of the native material. This coarser material will be more resistant to the erosive forces in the area and thus reduce annual losses that have been experienced in the past. The annual nourishment requirements are based on historic records with an adjustment for a more stable beach fill.

At an estimated cost of \$6.90 per cubic yard, the first cost of the beach fill project is estimated to be \$4,220,000 including contingencies, engineering and design and construction management. The project cost including future nourishment, based on historic records, is estimated at \$5,590,000 million. A more detailed financial analysis of the project cost is presented in Table 5.

#### ECONOMIC JUSTIFICATION

The reconnaissance level economic analysis compared damages that would occur to the concrete seawall and backshore structures with the cost of the beach fill protection project alternative put forth in this study. The damage figures are based on information provided by the Metropolitan District Commission regarding their seawall and backshore facilities and estimates of interior flood damages from waves overtopping the walls that were experienced during the October 30-31, 1991 storm, based on stage frequency curves shown in Appendix D.

The existing concrete seawalls that extend along the shoreline of the Metropolitan District Commission (MDC) Nantasket Beach Reservation in Hull were constructed in stages starting in 1915 and extending through 1938. The MDC currently estimates that the walls have a replacement value of \$12,880,000.

During recent times, a substantial amount of beach material has been eroded from in front of the seawalls to the extent that some of the footings are now exposed and in other areas the walls are being undermined. As a result during the December 11-12, 1992 coastal storm a 400 foot section of wall collapsed at the north end of the beach. Emergency repairs were made to the wall at a cost of about \$1,000,000.

The MDC estimates that under existing conditions they would need to expend \$2,679,000 annually to make needed repairs to maintain the integrity of the walls. This is based on their estimate that they would be required to replace about 1120 feet of wall annually. This represents one-fifth of the total length of walls.

As noted earlier in the report, flood damages to the backshore during the October 30-31, 1991 storm were not severe. Only a few structures experienced any first floor flooding. Most of the flood damages occurred to vehicles, landscaping and basements. Damages recurring from an event of this magnitude are estimated to be \$100,000.

Project benefits result from the reduction in damages to the seawall and the reduction in flooding damages to the backshore that could be attributed to the project. Damage reduction benefits are equal to the difference between damages with and without the project in place. In addition to these protection benefits, the project will also increase the amount of recreational beach area available for use by the general public during all stages of the tide. These benefits are not currently included in the economic analysis, but they will be evaluated in the Feasibility Phase of the study.

With the project in place to its full design dimensions, the future damages to the seawalls are expected to be minor. Thus, the annual project benefits for seawall damage reduction are estimated to be \$2,679,000.

As was noted in the Without Project Condition Section of the report, runup calculations were prepared with the beach project in place for the various return periods and design wave heights shown in Table 1. The results are shown in Table 3 below.

TABLE 3  
TOP OF AVERAGE WAVE  
RUNUP ALONG THE PROPOSED PROTECTIVE BEACH  
WITH A SLOPE OF IV:15H

<u>Return Period (Yrs)</u>	<u>Top of Average Wave Runup (feet above NGVD)</u>	<u>Average Height of Top of Wall (feet above NGVD)</u>	<u>Average Rate of Overtopping (CFS)</u>
100	17.3	16.2	1100
50	16.6	16.2	500
25	15.7	16.2	3
10	14.3	16.2	----
5	13.6	16.2	----
2	11.1	16.2	----

There are currently five commercial structures in Zone 1 located in the 100 year floodplain; 26 commercial structures and five residential structures are located in the 100 year floodplain in Zone 2; and there are 24 commercial buildings and 21 residential buildings in the 100 year floodplain in Zone 3. Using the stage frequency curves in Appendix D, the expected annual flood damages by zone for the existing conditions are:

Zone 1	\$ 400
Zone 2	35,200
Zone 3	<u>70,600</u>
	106,200

Backshore project benefits are derived from reduction in flooding damages provided by the project. Therefore annual flood damage estimates were developed both with and without the project in place. The difference in damage estimates by zone with and without the project in place which equal the projects benefit are shown below.

<u>Zone</u>	<u>Without Project Damages</u>	<u>With Project Damages</u>	<u>Project Benefits</u>
1	\$ 400	\$ 0	\$ 400
2	35,200	11,000	24,200
3	<u>70,600</u>	<u>37,000</u>	<u>33,600</u>
TOTAL	\$106,200	\$48,000	\$58,200

Table 4 below provides a summary of project benefits.

TABLE 4  
SUMMARY OF ANNUAL PROJECT BENEFITS

<u>TYPE</u>	<u>AMOUNT</u>
Seawall Damage Reduction	\$2,679,000
Backshore Flood Damage Reduction	<u>58,200</u>
TOTAL	\$2,737,200

The total first cost of construction is estimated to be \$4,220,000 as noted in Table 5. When this cost is annualized at 8-1/4% over a 50 year project life and annual nourishment costs are added, the total annual project costs are estimated to be \$374,500. When the annual benefits are divided by the annual costs, the benefit cost ratio is 7.1 to 1. Reducing the benefits from the avoided seawall damages by 50 percent results in a benefit-cost ratio of 3.6. Thus the proposed project has sufficient economic justification for proceeding to the Feasibility Study Phase.

For more information of the economic analysis see Appendix C.

TABLE 5  
SUMMARY OF PROJECT COSTS

(A) Estimated Implementation Costs

(1993 Price Level)

-	Scheduled Construction Costs		
	Sandfill 465,000 cy x \$6.90/cy		\$3,208,500
	Contingencies (25%)		<u>802,000</u>
		SUBTOTAL	\$4,010,500
	Planning, Engineering & Design		60,000
	Construction Management		<u>149,500</u>
			\$4,220,000
-	Unscheduled Construction Costs		
	Sandfill/Renourishment		
	4,000 cy/year x 49 years x \$7/cy		<u>1,370,000</u>
-	Total Estimated Implementation Cost		\$5,590,000
-	Cost Sharing of Estimated Implementation Costs		
		<u>Fed 3/</u>	<u>Non-Fed</u> <u>Totals</u>
	Preauthorization Studies	\$ 225,000	\$ 100,000    \$ 325,000
	Scheduled Construction Cost	1,775,000	2,445,000    4,220,000
	Unscheduled Construction Cost	<u>-0-</u>	<u>1,370,000</u> <u>1,370,000</u>
	TOTALS	\$2,000,000	\$3,915,000    \$5,915,000

(B) Economic Data  
(8-1/4% 50 Year Life)

Annual Charges <u>1/</u>	\$ 383,000
Annual Benefits <u>2/</u>	\$2,737,200
Benefit - Cost Ratio:	7.1

(C) Non-Federal Requirements:

LERRD	
Cash	
Reimbursements	<u>\$3,915,000</u>
TOTALS	\$3,915,000

The issue of how the non-Federal sponsor will meet the obligations for sharing in the implementation costs of the project will be addressed during the feasibility phase.

(D) Cost Allocation

The proposed project has the sole purpose of reducing storm damage and flooding during coastal storms.

(E) Federal Allocation to Date

Reconnaissance Study	\$125,000
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(F) Remaining Federal Requirements:

- Feasibility Phase	\$ 100,000
- Implementation Costs Including P&S	\$1,775,000

(G) Total Federal Investments: \$2,000,000

1/ Annual Charges

- Scheduled Construction Costs  
 $\$4,220,000 \times .08409$  (Int & Amort @ 8-1/4% for 50 years) =  
\$ 355,000

- Unscheduled Construction Costs (Nourishment is estimated on an average annual basis. It will, however, be carried out after several years of erosional loss).

4,000 cy/year x \$7/cy	= <u>28,000</u>
	\$383,000

2/ See Table 4 for the derivation of the annual benefits.

3/ The Federal share of implementation costs for projects resulting in public benefits due to storm damage reduction is 65% including reconnaissance and feasibility costs. The Federal costs respectively of the reconnaissance and feasibility studies are \$125,000 and \$100,000 for a total of \$225,000. Section 103 of Public Law 87-874, as amended, however, imposes a \$2,000,000 limit on overall Federal expenditure, including preauthorization studies.

#### REAL ESTATE REQUIREMENTS

There is only one ownership potentially involved in the land required for the proposed shore protection and flood damage reduction project. The land is a public beach and is owned by the Commonwealth of Massachusetts, under the jurisdiction of the Metropolitan District Commission. There are no potential Public Law 91-646 relocations. No real estate interest needs to be acquired for a shore protection and flood damage reduction project at Nantasket Beach.

#### ENVIRONMENTAL CONCERNS

An assessment of the environmental impacts from the sand fill alternative plan considered for Nantasket Beach are summarized below.

Under the "no action" alternative the concrete seawalls and riprap revetment would continue to be damaged and overtopped causing flooding to the backshore area. Sandfill in front of the seawall would continue to erode. From an environmental standpoint the existing environment and impacts will remain as is.

Environmental concerns as they relate to project implementation would lie with the potential for impact to the commercially harvestable populations of the surf clam and lobsters. Prior to project construction and in preparation of the Environmental Assessment, it will be necessary to quantify, through a formal sampling program, the existing benthic and shellfish resources that may inhabit the area. Should sufficient numbers of these individuals be at risk, a relocation plan may be implemented which would temporarily remove existing resources to unaffected areas and then repopulate the stabilized area upon completion of the work.

#### ENVIRONMENTAL FINDINGS

Initial coordination with Federal, State and local agencies have revealed no outstanding or unreasonable environmental issues. The reconnaissance investigations described above conclude that impacts to the surf clam population are expected to be minor. No Federal or State threatened, endangered, or rare species are known to exist in the project area.

The proposed project could possibly impact prehistoric or underwater archaeological resources, which may be in the vicinity of the project area. There are approximately twenty-seven (27) documented shipwrecks that may be located in the vicinity, as well as, at least eight (8) prehistoric archaeological sites which are known within the Hull area. Floodproofing measures which may be performed on historic homes near the proposed project area, could also impact significant resources. However, this is a preliminary investigation, and if this project proceeds to a further stage in the planning process, then formal comments will be requested from the Massachusetts State Historical Preservation Officer to satisfy Section 106 of the National Historic Preservation Act. In a letter dated November 27, 1992, the Massachusetts Historical Commission concurred with these determinations.

### CONCLUSIONS

The shore damage to the concrete seawalls and riprap revetment and backshore flooding problems at Nantasket Beach in Hull, Massachusetts has been studied and alternatives to alleviate these concerns have been formulated. Based upon reconnaissance level engineering, economic and environmental study and review of the problem a solution has been developed and with the support of the MDC, the New England Division, Corps of Engineers, finds sufficient benefits will accrue to the MDC and town of Hull, to warrant a more detailed study.

Federal policy guidelines state that the reconnaissance phase of a study consists of all work and analysis required to determine whether there is an interest in Federal planning and to obtain necessary agreements with the local sponsor. These requirements have been met by this report. The local sponsor has agreed to the Feasibility Cost Sharing Agreement and the Scope of Services as detailed in the next section of this report.

### RECOMMENDATIONS

The Division Engineer recommends that authority and appropriations be delegated to pursue the Section 103 Feasibility Phase Study for Nantasket Beach, Hull, Massachusetts. This feasibility study will be cost shared on a 50/50 basis with the MDC.

25 AUGUST 1993

Date



Brink P. Miller  
Colonel, Corps of Engineers  
Division Engineer



## DESCRIPTION OF FEASIBILITY PHASE STUDIES REQUIRED

The Feasibility Phase will entail in-depth environmental, engineering and economic evaluations of the alternate plans described above, each in such detail as is required to first select the best plan and then to develop its specifics. The product will be a Detailed Project Report (DPR). If a positive recommendation is forwarded, the DPR will be the basis for preparation of Plans and Specifications. In Section II of this report, Appendix A, the Scope of Studies, delineates the required tasks to be performed during this phase and details the cost of each task. Appendix B summarizes the feasibility study cost estimate. Appendix C discusses the cost sharing of the feasibility phase.

## ACKNOWLEDGMENTS

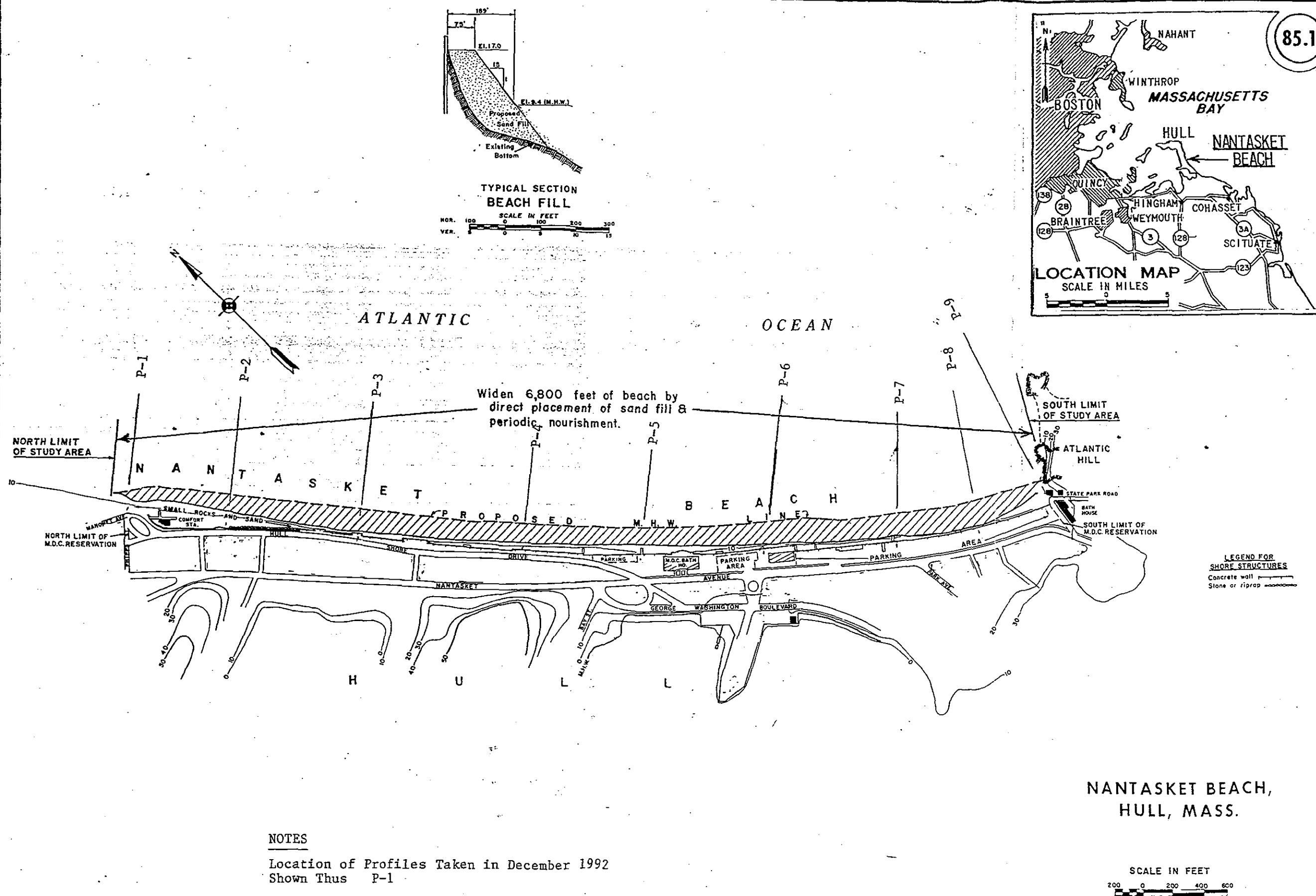
The New England Division, U.S. Army Corps of Engineers prepared this report under the direction of Colonel Brink P. Miller, Division Engineer. It was prepared by Mr. William T. Coleman, Project Manager, under the supervision of Mr. John T. Smith, Chief, Coastal Development Branch, Mr. Paul E. Pronovost, Chief, Plan Formulation Division and Mr. Joseph L. Ignazio, Director of Planning.

Members of the Study Team include:

- Mr. Ed O'Leary - Economic Analysis
- Mr. Mark Paiva - Historic Properties
- Mr. Jay Mackay - Environmental Considerations
- Mr. Bob Meader - Coastal Engineering
- Mr. Bob Simeone - Geotechnical Engineering
- Mr. Dan Stenstream - Geotechnical Engineering
- Mr. Tony Siegel - Cost Engineering
- Ms. Carmen Suarez - Hydrologic and Hydraulic Analysis
- Ms. Ulrika Volz - Hydrologic and Hydraulic Analysis
- Ms. Maureen McCabe - Real Estate
- Mr. Ed Fallon - Real Estate

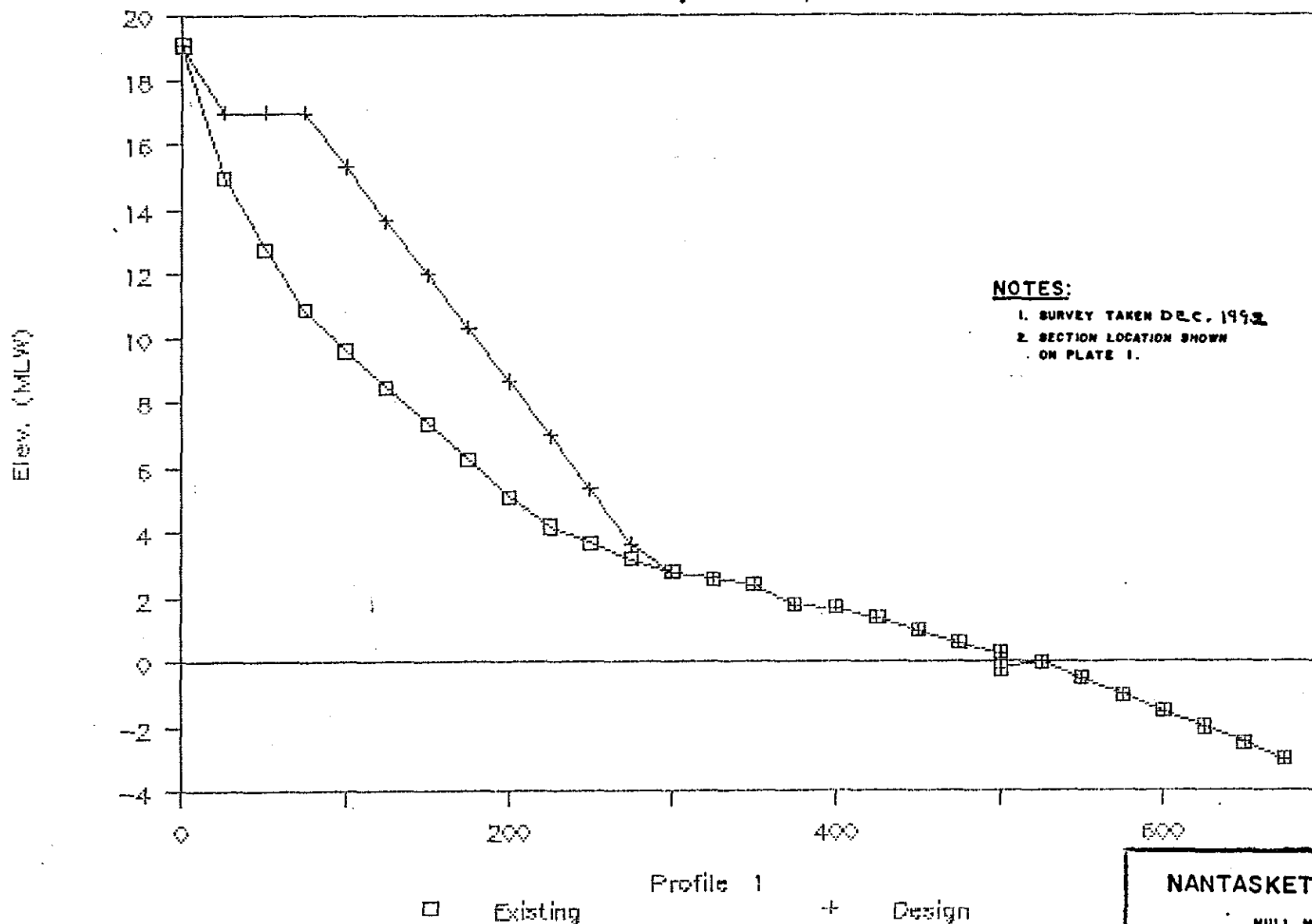
This report was prepared for publication by Ms. Kathy Bucciarelli and Mr. Edward Madigan.

Special thanks are extended to Mr. Carnie Terzian and Mr. Henry Higgott of the Metropolitan District Commission whose cooperation and assistance proved invaluable during the course of this study.



# Nantasket Beach

Reconnaissance Report



NANTASKET BEACH STUDY

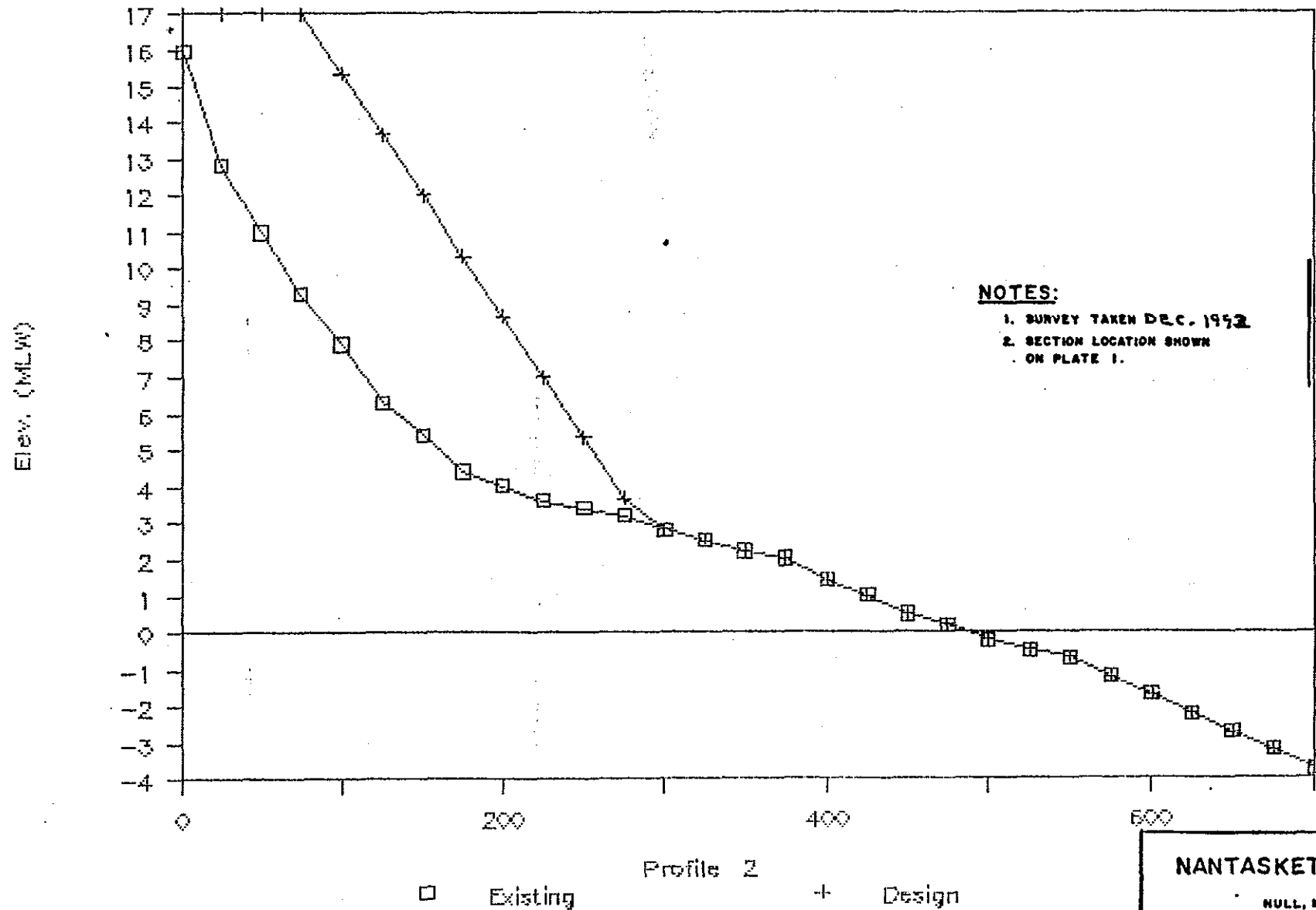
NANTASKET, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 2

# Nantasket Beach

Reconnaissance Report



NANTASKET BEACH STUDY

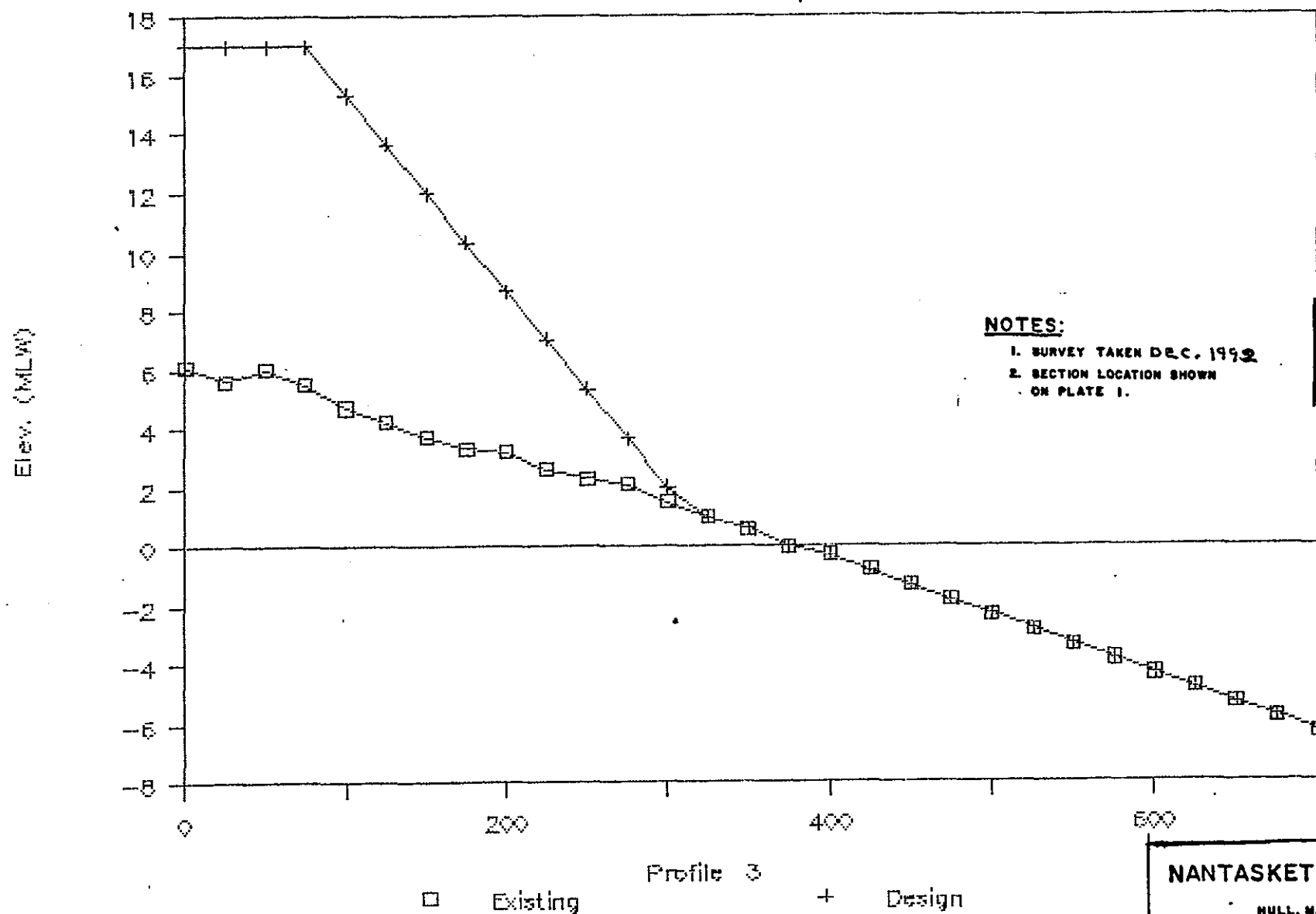
NANTASKET, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 3

# Nantasket Beach

## Reconnaissance Report



NANTASKET BEACH STUDY

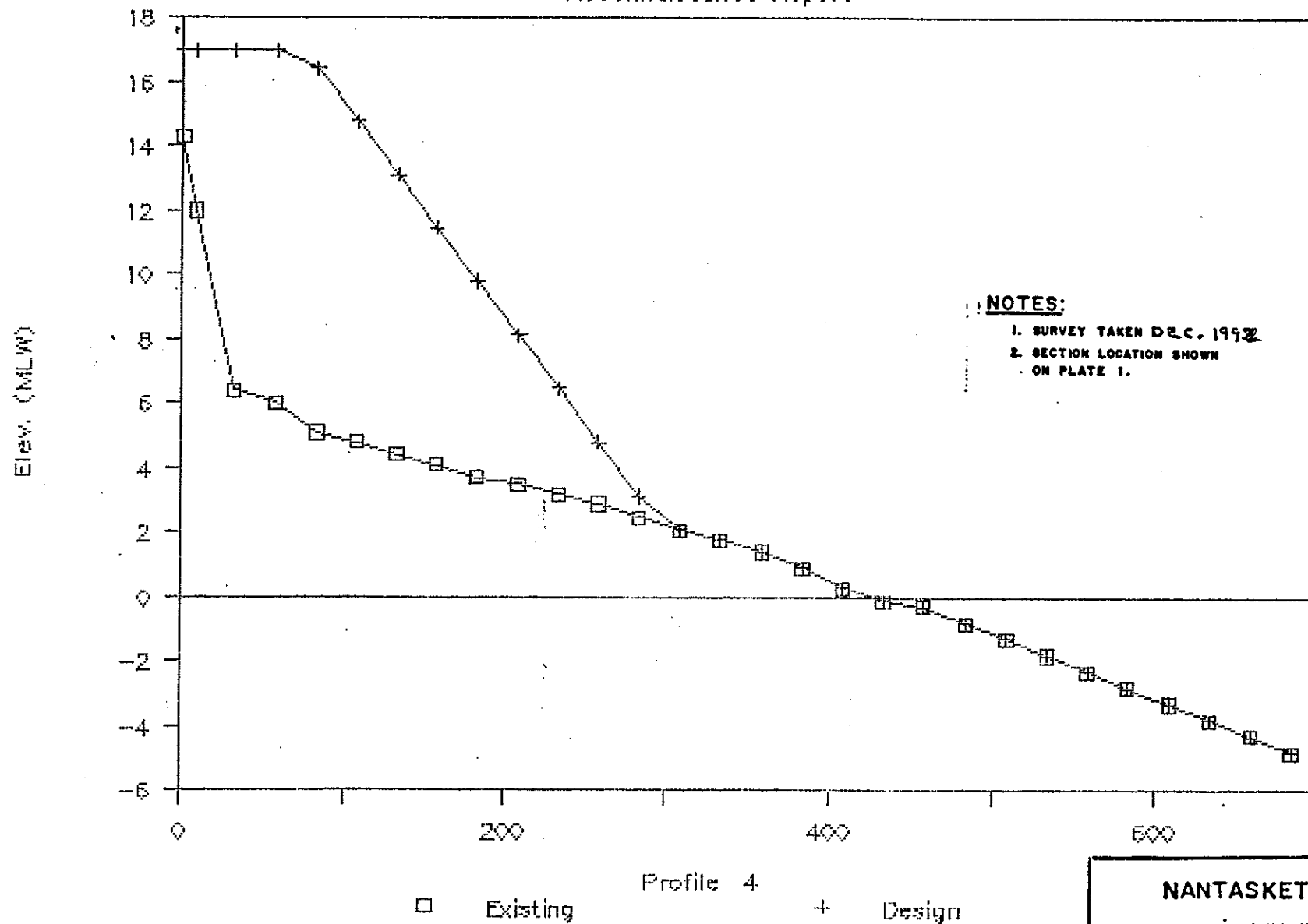
NANTASKET BEACH, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 4

# Nantasket Beach

## Reconnaissance Report



NANTASKET BEACH STUDY

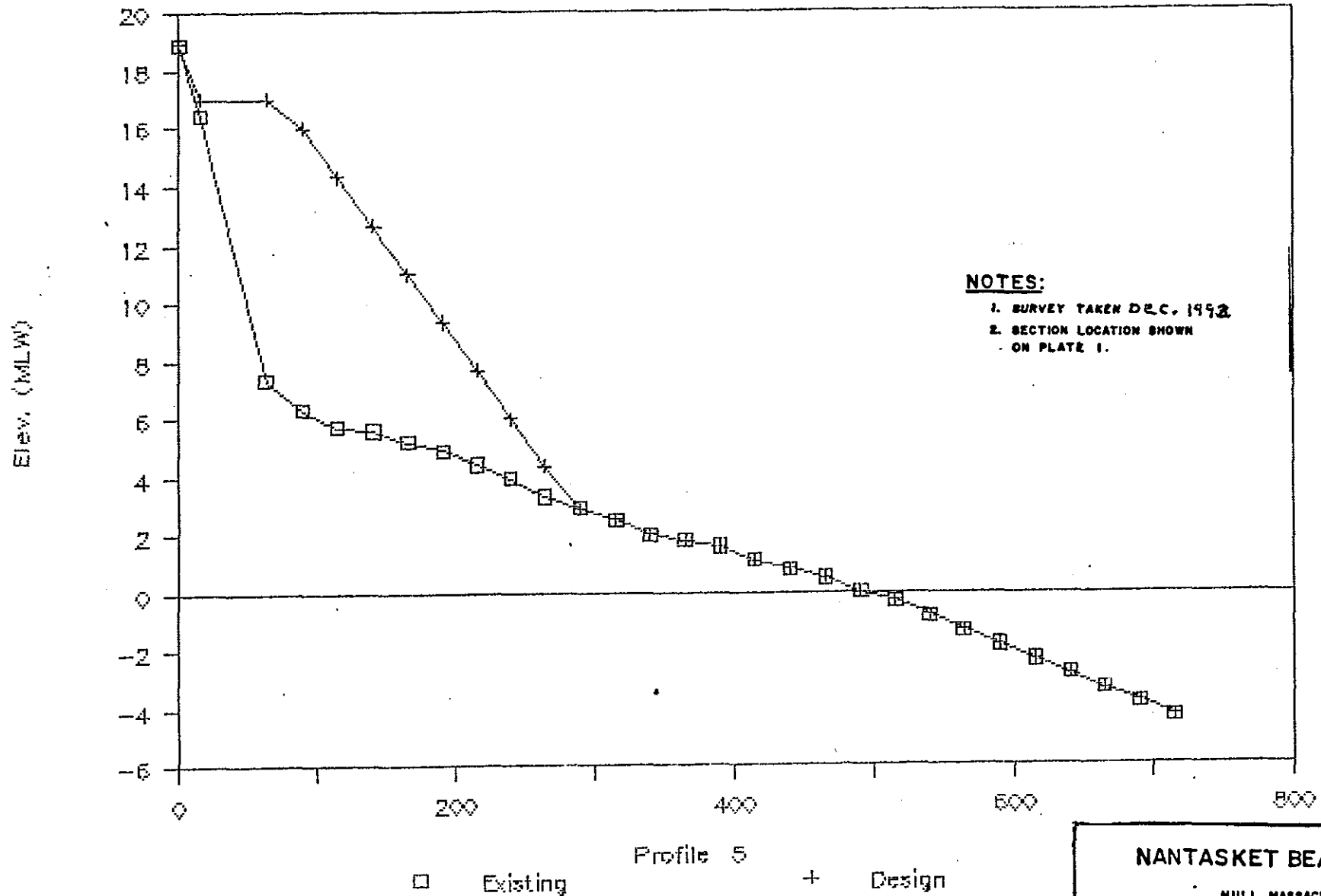
HULL, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 5

# Nantasket Beach

## Reconnaissance Report



NANTASKET BEACH STUDY

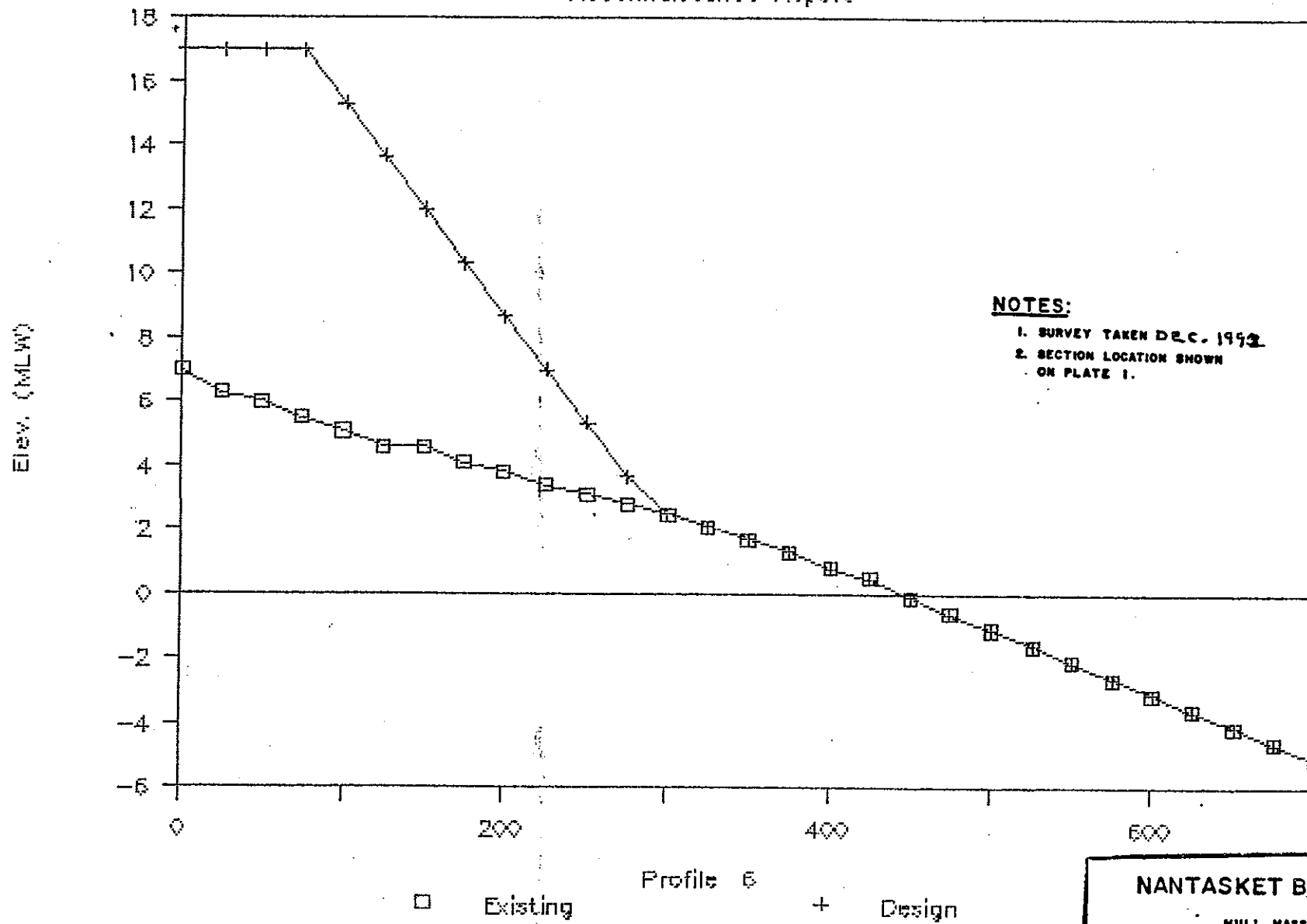
HULL, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 6

# Nantasket Beach

## Reconnaissance Report



NANTASKET BEACH STUDY

MULL, MASSACHUSETTS

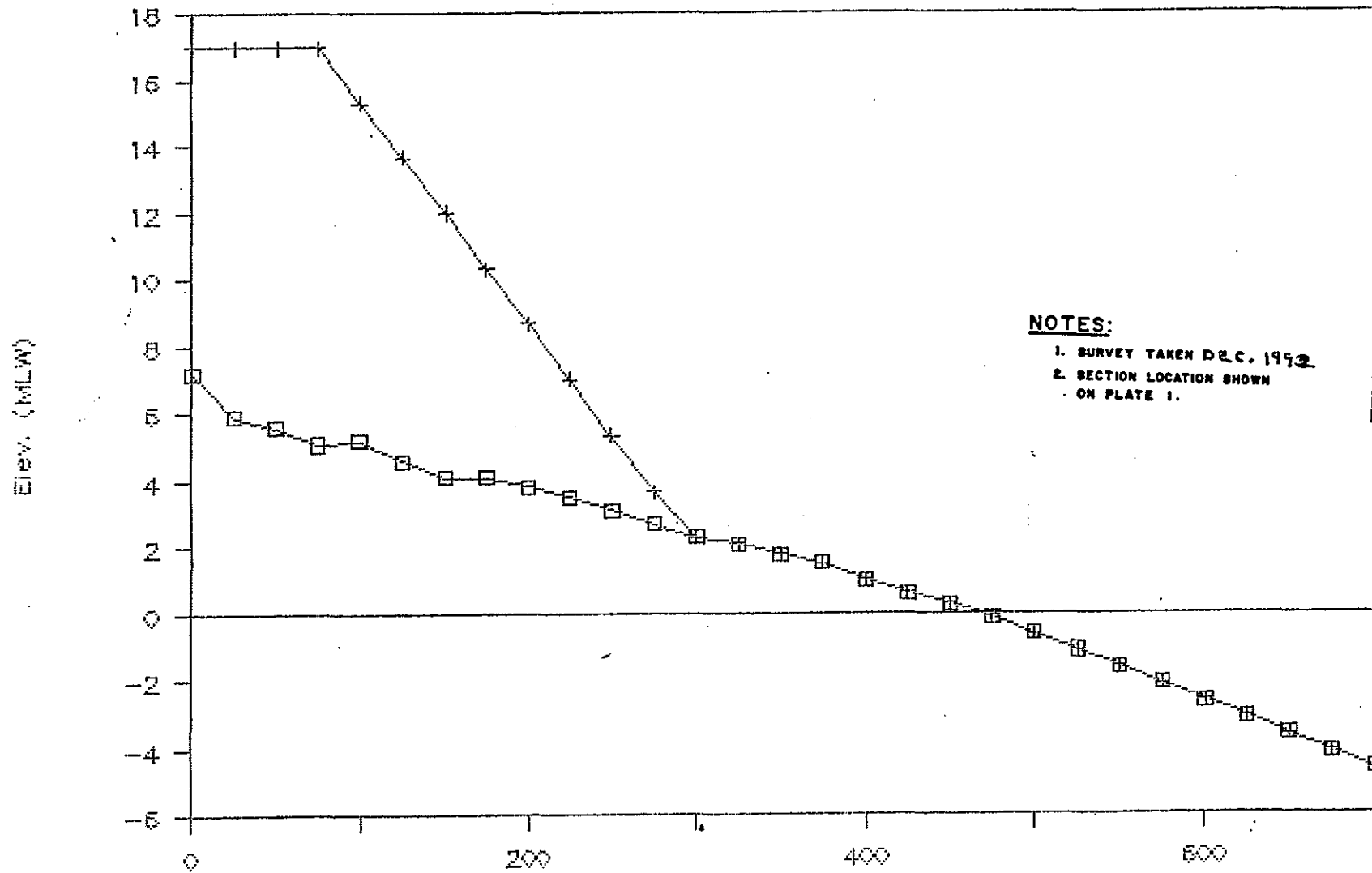
NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 7



# Nantasket Beach

Reconnaissance Report



## NOTES:

1. SURVEY TAKEN DEC. 1952
2. SECTION LOCATION SHOWN ON PLATE 1.

□

Existing

Profile 7

+

Design

NANTASKET BEACH STUDY

HULL, MASSACHUSETTS

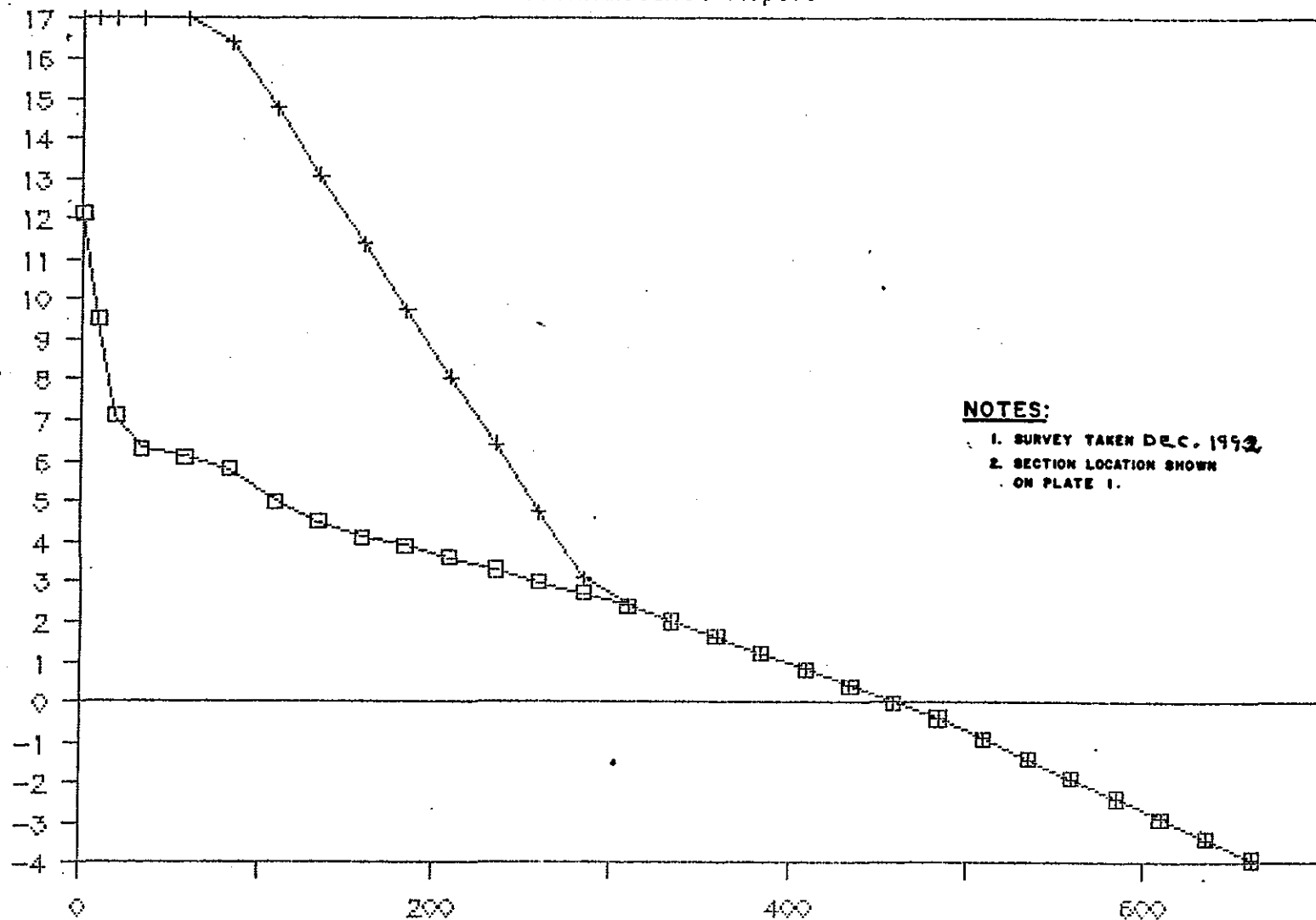
NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 8

# Nantasket Beach

Reconnaissance Report

Elev. (MLW)



## NOTES:

1. SURVEY TAKEN DEC. 1952
2. SECTION LOCATION SHOWN ON PLATE 1.

□ Existing      Profile 8      + Design

**NANTASKET BEACH STUDY**

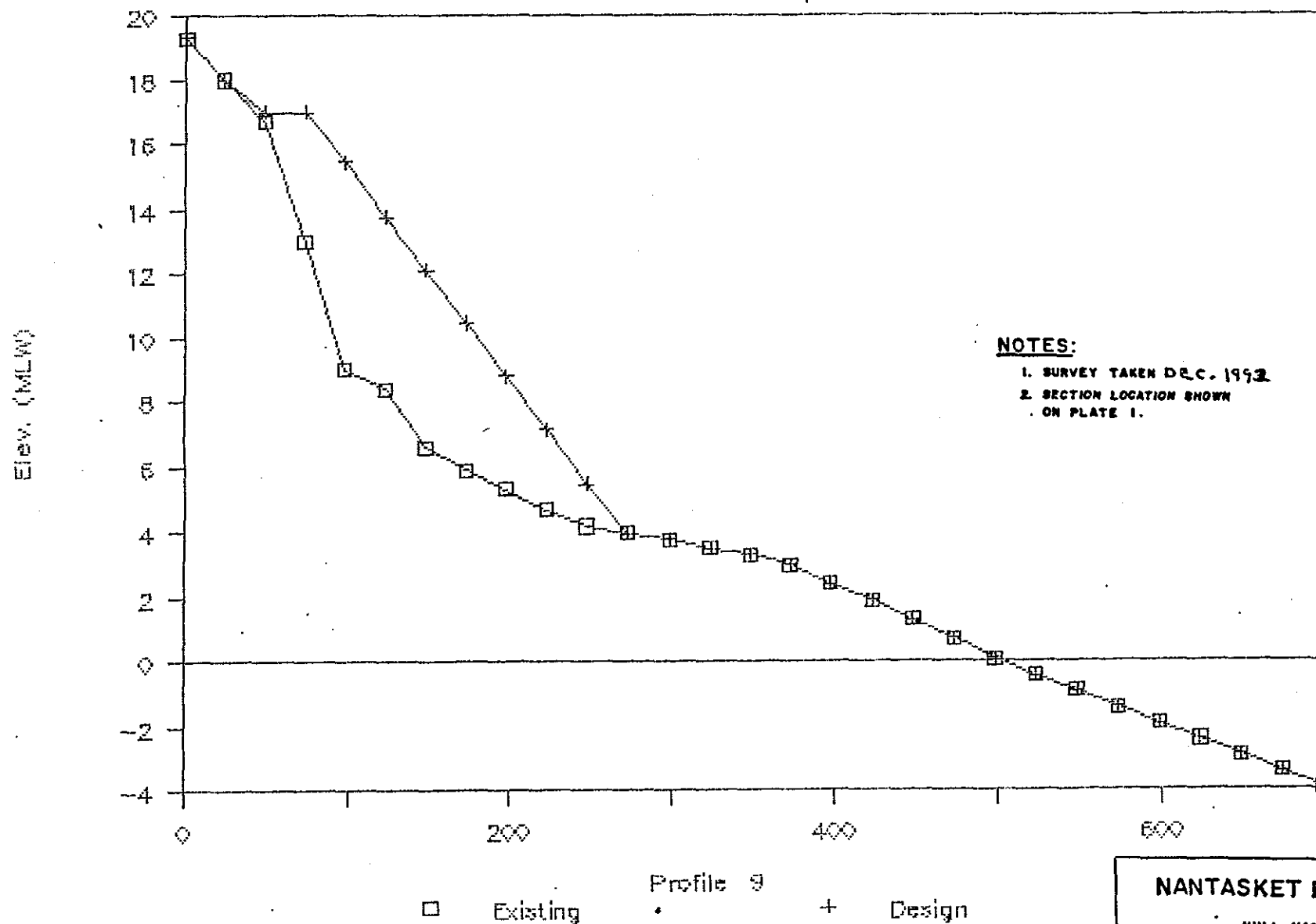
HULL, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 9

# Nantasket Beach

Reconnaissance Report



NANTASKET BEACH STUDY

MULL, MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE 10

## SECTION II

### FEASIBILITY COST SHARING AGREEMENT

Updated: 2 December 93

D R A F T

FEASIBILITY COST SHARING AGREEMENT

COST SHARING AGREEMENT  
BETWEEN THE UNITED STATES OF AMERICA  
AND  
THE COMMONWEALTH OF MASSACHUSETTS  
FOR THE  
NANTASKET BEACH COASTAL SHORE PROTECTION  
FEASIBILITY STUDY

THIS AGREEMENT, entered into this \_\_\_\_\_ day of \_\_\_\_\_, 199 by and between the United States of America (hereinafter called the "Government"), represented by the Contracting Officer executing this Agreement, and the Commonwealth of Massachusetts (hereinafter called the "Sponsor"), acting by and through its Metropolitan District Commission,

WITNESSETH, that

WHEREAS, the Congress has authorized the Corps of Engineers to conduct studies of shore erosion problems pursuant to the continuing authority provided by Title I, Section 103, 74' Stat. 484, 33USC426: and

WHEREAS, the Corps of Engineers has conducted a preliminary study of shore damage and flooding caused by waves impacting and overtopping backshore concrete walls at Nantasket Beach, Hull, Massachusetts, hereinafter referred to as the "Reconnaissance Phase Study", pursuant to this authority, and has determined that further study in the nature of a "Feasibility Phase Study" (hereinafter called the "Study") is required to fulfill the intent of the study authority and to complete the determination of the extent of the Federal interest in alleviating potential shore damage and backshore flooding; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in Study cost sharing and financing in accordance with the terms of this

Agreement; and

WHEREAS, the Sponsor considers it in its best interest to have the Study promptly completed, and is willing to contribute fifty (50) percent of the total Study Cost to facilitate its prompt completion; and

WHEREAS, the Sponsor and the Government both understand that entering into this agreement in no way obligates either party to implement a project and that whether a project is supported for authorization and budgeted for implementation depends upon the outcome of this Feasibility Study and whether the proposed solution is consistent with the Principles and Guidelines and with the budget priorities of the Administration and that at the present time, favorable budget priority is being assigned to projects providing primarily commercial navigation and flood or storm damage reduction outputs; and

WHEREAS, the Water Resources Development Act of 1986 (P. L. 99-662) specifies the cost sharing requirements applicable to the Study;

NOW THEREFORE, the parties agree as follows:

#### ARTICLE I - DEFINITIONS

For the purpose of this Agreement:

a. The term "Study Cost" shall mean all disbursements pursuant to this Agreement, whether from Federal appropriations or from funds made available to the Government by the Sponsor, and all negotiated costs of work performed by or contracted for by the Sponsor pursuant to this Agreement. Such costs shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; and contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement. Additionally, the "Study Cost" includes a Review Contingency equal to the lesser of five (5) per centum of the "Study Cost" or \$10,000, such amount to be used in the event of work required as a result of Division or Headquarters level review. Any review costs which exceed this amount or that are incurred after the end of the decision document study phase will be borne entirely by the Federal Government.

b. The term "Study Period" shall mean the time period for conducting the Study commencing when funding from both the Sponsor and the Federal Government is available for expenditure following the execution of this Agreement and ending with the Chief of Engineers' acceptance of the Study.

c. The term "Negotiated Cost" is the cost of a work item, accomplished other than by contract, to be accomplished by the Sponsor as an in-kind service.

## ARTICLE II - OBLIGATIONS OF PARTIES

a. The Sponsor and the Government, using funds contributed by the Sponsor and appropriated by the Congress, shall expeditiously prosecute and complete the Study currently estimated to be completed in 18 months from the commencement of the Study Period ( Article I b. above), substantially in compliance with Article III herein, and in conformance with applicable Federal and state laws and regulations, the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" and mutually acceptable standards of engineering practice.

b. The Government and the Sponsor shall each provide, in cash, contracts, and in-kind services, fifty (50) percent of all Study Costs, which Study Cost is currently estimated at \$200,000, as specified in Article IV herein; provided, that the Government shall, as specified in Article V herein, periodically give credit against cash contributions required of the Sponsor for any Study Costs of the Sponsor as documented under Article V (d) herein; provided further, the Government shall not obligate any cash contribution by the Sponsor toward Study Costs until such cash contribution has actually been made available to it by the Sponsor.

c. No Federal funds may be used to meet the Local Sponsor share of study costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified by the granting agency.

d. The award of any contract with a third party for services in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within the control of the Government. The award of any contract by the Sponsor with a third party for services in furtherance of this Agreement which obligates funds of the Sponsor and does not obligate Federal appropriations shall be exclusively within the control of the Sponsor, but shall be subject to applicable Federal statutes and regulations.

e. The Government and the Sponsor shall each endeavor to assign the necessary resources to provide for the prompt and proper execution of the Study and shall, within the limits of law and regulation, conduct the study with maximum flexibility as directed by the Executive Committee established by Article V herein.

f. The Government will not continue with the Study if it determines that there is no solution in which there is a Federal interest which is not in accord with current policies and budget priorities unless the Sponsor wishes to continue under the terms of this Agreement and the Department of the Army grants an exception. If a study is discontinued, it shall be concluded according to Article XII and all data and information shall be made available to both parties.

g. The Sponsor may wish to conclude the study if it determines that there is no solution in which it has an interest or which is not in accord with its current policies and budget priorities. When such a case exists the study shall be concluded according to Article XII and all data and information shall be made available to both parties.

#### ARTICLE III - SCOPE OF STUDIES

Appendix A, Scope of Studies and Detailed Costs; Appendix B, Feasibility Phase Study Cost Estimate Summary; and Appendix C, Feasibility Phase Study Cost Sharing are hereby incorporated into this Agreement. The parties to this Agreement shall substantially comply with the Scope of studies in prosecuting work on the Study. The following modifications shall require an amendment to this Agreement.

a. any modification which increases the total Study Cost by more than fifteen (15) percent (see Appendices A and B);

b. any modification in the estimated cost of a Study work item or any obligation for a Study work item, which changes the total cost of that work item by more than fifteen (15) percent (see Appendices A and B);

c. any extension of the Study completion date of more than thirty (30) days; or

d. any reassignment of work items between the Sponsor and the Government (see Appendices A, B and C).

#### ARTICLE IV - METHOD OF PAYMENT

a. The Government shall endeavor to obtain the appropriation for the amount specified in the Scope of Studies incorporated herein. Subject to the enactment of Federal appropriations and the allotment of funds to the Contracting Officer, the Government shall then fund the Study at least in the amounts specified herein.

b. The Sponsor shall contribute and deliver within thirty (30) days from the signing of this Agreement the cash contribution in the amount specified in the Scope of Studies (Appendix A) incorporated herein and, such funds shall be made available to the Government. The Government shall withdraw and disburse funds made available by the Sponsor subject to the provisions of this Agreement.

c. Funds made available by the Sponsor to the Government and not disbursed by the Government within a Government fiscal year shall be carried over and applied to the cash contribution for the succeeding Government fiscal year; provided, that, upon study termination any excess cash contribution shall be reimbursed to the Sponsor after a final accounting, as specified in Article XII herein.



d. Should either party fail to obtain funds sufficient to make obligations or cash contributions or to incur Study Costs in accordance with the schedule included in the Scope of Studies incorporated herein, it shall at once notify the Executive Committee established under Article V herein.

#### ARTICLE V - MANAGEMENT AND COORDINATION

a. Overall Study management shall be the responsibility of an Executive Committee consisting of:

The Government

Division Engineer  
Director of Planning

Commonwealth of Massachusetts

Commissioner, Metropolitan  
District  
Commission

b. To provide for consistent and effective communication and prosecution of the items in the Scope of Studies, the Executive Committee shall appoint representatives to serve on a Study Management Team.

c. The Study Management Team will coordinate on all matters relating to prosecution of the Study and compliance with this Agreement, including cost estimates, schedules, prosecution of work elements, financial transactions and recommendations to the Executive Committee for termination, suspension, or amendment of this Agreement.

d. The Study Management Team will prepare quarterly periodic reports on the progress of all work items for the Executive Committee.

#### ARTICLE VI - DISPUTES

a. The Study Management Team shall endeavor in good faith to negotiate the resolution of conflicts. Any dispute arising under this Agreement which is not disposed of by mutual consent shall be referred to the Executive Committee. The Executive Committee shall resolve such conflicts or determine a mutually agreeable process for reaching a resolution or for termination under Article XII herein.

b. Pending final decision of a dispute hereunder, or pending suspension or termination of this Agreement under Article XII herein, the parties hereto shall proceed diligently with the performance of this Agreement.

#### ARTICLE VII - MAINTENANCE OF RECORDS

The Government and the Sponsor each shall keep books, records, documents and other evidence pertaining to Study Costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total Study Costs. The

Government and the Sponsor shall maintain such books, records, documents and other evidence for inspection and audit by authorized representatives of the parties to this Agreement. Such material shall remain available for a period of three (3) years following the termination of this Agreement.

#### ARTICLE VIII - RELATIONSHIP OF PARTIES

a. The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

b. To prevent conclusive findings, recommendations, etc., from being prematurely and or indiscriminately released against the wishes of either party and to avert misinterpretations and misunderstandings, the following is effected for the period of this Agreement: Prior to approval for public release, except where Federal law otherwise requires disclosure, final Study determinations, including reports, documents, data, findings, conclusions, and recommendations pertaining to the Study, shall not be released without the consent of both parties, nor shall they be represented as presenting the views of either party unless both parties shall indicate explicit agreement.

#### ARTICLE IX - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or other elected official, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

#### ARTICLE X - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Local Sponsor agrees to comply with all Federal and State laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

#### ARTICLE XI - COVENANT AGAINST CONTINGENT FEES

The Local Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Local Sponsor for the purpose of securing business. For breach or violation

of this warranty, the Government shall have the right to annul this Agreement without liability or, in its sole discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

## ARTICLE XII - TERMINATION OR SUSPENSION

a. This Agreement shall terminate at the completion of the Study Period: provided, that prior to such time and upon thirty (30) days written notice, either party may terminate or suspend this Agreement without penalty.

b. Within ninety (90) days upon termination of this Agreement the Study Management Team shall prepare a final accounting of the Study Costs, which shall display disbursements by the Government of Federal funds, cash contributions by the Sponsor, and credits for the Negotiated Costs of the Sponsor as defined elsewhere herein. Within thirty (30) days thereafter, the Government shall, subject to the availability of funds, reimburse the Sponsor for the excess, if any, of cash contributions and credits given over fifty (50) percent of the total Study Costs. Within thirty (30) days thereafter, the Sponsor shall provide the Government any cash contributions required so that the total Sponsor share equals fifty (50) percent of the total Study Cost.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

THE UNITED STATES OF AMERICA

COMMONWEALTH OF  
MASSACHUSETTS

BY \_\_\_\_\_

BY \_\_\_\_\_

Colonel, Corps of Engineers

Mr. M. Ilyas Bhatti

Division Commander

Commissioner  
Commonwealth of Massachusetts  
Metropolitan District  
Commission

Appendix A - Scope of Studies  
Appendix B - Study Cost Estimate  
Appendix C - Cost Sharing Description

CERTIFICATE OF AUTHORITY

I, \_\_\_\_\_, do hereby certify that I am the Attorney General for the Commonwealth of Massachusetts, and that the Commonwealth of Massachusetts is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the United States of America and the Commonwealth of Massachusetts in connection with the Nantasket Beach Coastal Flood Protection Feasibility Study and to pay damages, if necessary, in the event of the failure to perform, and that the persons who have executed the Agreement on behalf of the Commonwealth of Massachusetts have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certificate this \_\_\_\_ day of \_\_\_\_\_, A.D., 199 .

BY \_\_\_\_\_  
Attorney General

## APPENDIX A

### SCOPE OF STUDIES AND DETAILED COSTS

#### CORPS OF ENGINEERS WORK FOR COST SHARED FEASIBILITY PHASE STUDY

#### NANTASKET BEACH COASTAL FLOOD PROTECTION STUDY HULL, MASSACHUSETTS

##### Public Contact and Involvement (Item 1)

Public involvement will be a major work item. Several meetings are planned. In addition to the MDC, close coordination with the Selectmen and other town officials will be maintained. In addition to the time directly spent in meetings, a significant work effort will be needed for planning and coordination.

Element	Description	Estimated Cost
*	Three informational meetings with the general public. Early in the process, at the middle and end of the study.	\$ 1,500
*	Quarterly visits with the MDC officials and recorded progress reports of the meetings.	\$ 2,000
*	Three planning and information gathering visits with town, State and Federal officials.	\$ 1,500
*	Meeting preparation, planning and evaluation of results. Preparation and dissemination of pertinent information.	<u>\$ 3,000</u>
Subtotal		\$ 8,000

##### Hydrology Studies (Item 2)

Technical and engineering information to be compiled by the Hydrologic Engineering and Hydraulics and Water Quality sections will focus on analysis of wind and wave climate, wave overtopping, past flooding, interior drainage and formulation or update of stage

frequency curves for both the shore line and interior areas. Such information will be used in the design of the various plans studied as well as in the economic cost benefit analyses.

* Analysis of wave, storm surge and wind frequency	\$ 5,000
* Determination of wave overtopping volumes.	\$ 4,000
* Compilation of past flood high watermarks	\$ 2,000
* Review of interior drainage processes and rainfall handling capabilities and requirements.	\$ 3,500
* Development of existing and future stage frequency relationships for both tidal and interior areas.	\$ 4,500
* Preparation of report	\$ 4,500
* Coordination with study team	<u>\$ 1,500</u>
Subtotal	\$ 25,000

It is estimated that most of the hydrology work will be performed during the middle 6 months of the project. Much of the work cannot begin until surveying information is complete. A significant amount of the information compiled during the hydrology study must be completed early enough to be used in the economic analysis of the feasibility study.

### Surveying and Mapping (Item 3)

Surveying of the backshore of the study area will be necessary to determine elevations of buildings and roadways. The survey of the beach, taken in December of 1992, will be updated and new profiles will be determined. The interior elevations are necessary to provide information for use in the determination of stage frequency curves for flooding. Such elevations are also necessary for the formulation of stage damage curves in conjunction with economic and cost benefit analyses.

* Backshore of study area.	\$ 9,000
* Update of beach survey and new profiles.	\$ 6,000
* Preparation of map and profiles.	<u>\$ 2,500</u>
Subtotal	\$ 17,500

#### Materials Investigation (Item 4)

Comprehensive survey, with supporting analysis,  
of potential source samples. \$ 2,500

#### Design & Cost Estimates (Item 5)

Prepare quantity and cost estimates for alternative plans of improvement. Evaluate alternative plans to arrive at the best plan for the area and maximize benefits. Several different scenarios for design wave and design berms will be prepared. It will be necessary to prepare drawings, draft and layout cross sections, plans and profiles and prepare a report to be used in the feasibility report.

* Design wave analysis - three scenarios	\$ 3,000
* Design berm - three scenarios	\$ 3,000
* Breakwater design evaluation	\$ 1,000
* Revetment design evaluation	\$ 1,000
* Coordination	\$ 2,000
* Quantity and cost estimates	\$ 4,000
* Drafting	\$ 3,000
* Report writing and review	<u>\$ 3,000</u>

Subtotal \$ 20,000

#### Economic Studies (Item 6)

Assess and evaluate the economic and social effects of the structural and nonstructural alternate plans. Net benefits will be maximized and the most cost effective plan will be determined through economic analyses. A final report will be submitted to be used in the feasibility report. Several field trips will be necessary.

* Determine existing shore and backshore flooding damages	\$ 10,000
* Determine future damages	\$ 2,500

* Refine existing without project stage damage functions	\$ 10,000
* Prepare report	\$ <u>7,500</u>
Subtotal	\$ 30,000

#### Environmental Studies (Item 7)

Perform the necessary field surveys including any necessary transects, cores, specimen collection and identification, and biomass assessment. Determine impacts on the environment anticipated as a result of the construction of the project. Coordinate these efforts with state and Federal agencies such as National Marine Fisheries Service, and Massachusetts Coastal Zone Management. Field trips will be necessary to complete this work. Also prepare and submit an Environmental Assessment in accordance with NEPA, MEPA and applicable state laws and regulations for enclosure in the feasibility report.

* Benthic survey; specimen collection, enumeration and identification.	\$ 5,000
* Data acquisition	\$ 2,000
* Coordination with federal, state and local agencies.	\$ 2,500
* Report preparation including appropriate NEPA documentation, 404 (b) (1) evaluation and necessary CZM/WQC material.	\$ 8,000
* Local Cooperation	\$ 1,000
* Public review/revision	\$ <u>2,000</u>
Subtotal	\$ 20,500

#### U.S. Fish and Wildlife Coordination (Item 8)

U.S. Fish and Wildlife Service, in agreement with the Intergovernmental Coordination Act of 1966, will review the project in terms of its environmental acceptability. Includes site visit(s), comment, and correspondence. Two field trips are anticipated, and Planning Aid Letters will be provided.

\$ 8,000



Study Management (Item 9)

The overall management and coordination of the entire project includes several elements.

* Coordination with study team members; team meetings, correspondence, interaction with teams.	\$ 5,000
* Review of work submitted by team members.	\$ 3,500
* Maintenance of financial records and budget; monitoring of expenditures and adherence to work schedules.	\$ 3,000
* Inter/Intra-office correspondence.	\$ 1,500
* Fact Sheet preparation and update	\$ 2,000
* Monthly Progress Reports	\$ 3,500
* Coordinate assignments for study team members.	\$ 2,000
* Establish work and expenditure schedules.	<u>\$ 1,500</u>
Subtotal	\$ 22,000

Report Preparation and Corps Review (Item 10)

The compilation of the draft report for review prior to submission entails a variety of tasks including:

* Writing of text (rough, draft and preliminary).	\$ 7,000
* Preparation of figures and tables.	\$ 2,000
* Compilation and review of appendices.	\$ 2,000
* Editing main report.	\$ 2,500
* Corps review and in house coordination with team members.	\$ 4,000
* Reproduction and mailing.	\$ 4,000
* Project Review Board meeting.	<u>\$ 1,000</u>
Subtotal	\$ 22,500

### Institutional Analysis (Item 11)

The Office of Counsel will address legal questions that may arise during the study and will assist in preparation of Local Cooperation Agreement in preparation for the construction of the project. Office of Counsel expenses are absorbed into NED overhead costs.

### Audit (Item 12)

The Audit Branch will examine, review, and verify the financial accounts, as appropriate.

\$ 1,000

### Archaeology (Item 13)

- \* Background research to determine the historic and prehistoric site potential for the project area. \$ 2,500
- \* Site visit to determine architectural significance of structures in the study area. \$ 500
- \* Completion of Section 106 (National Preservation Act) coordination with Massachusetts State Historic Preservation Officer. \$ 1,000
- \* Input to Environmental Assessment \$ 500
- Subtotal \$ 4,500

### Real Estate (Item 15)

The Real Estate Directorate will provide a gross appraisal and planning report for the properties affected, prepare the draft Local Cooperation Agreement and perform other administrative work for the Detailed Project Study.

\$ 8,500

### Review Contingency (Item 16)

The "Study Cost" includes a Review Contingency equal to the lesser of five (5) percent of the "Study Cost" or \$10,000, such amount to be used in the event of work required as a result of Division or Headquarters level review. (Article Ia. in the Agreement.)

\$ 10,000

Point of Contact with the Commonwealth of Massachusetts:

Mr. Francis D. Faucher, P.E.  
Deputy Director  
Engineering and Construction Division  
Metropolitan District Commission  
20 Somerset Street  
Boston, Massachusetts 02108

Point of Contact with the Corps of Engineers will be:

Mr. Charles L. Joyce  
CENED-PL-P  
U.S. Army Corps of Engineers  
New England Division  
424 Trapelo Road  
Waltham, Massachusetts 02254-9149

# APPENDIX B

## NANTASKET BEACH COASTAL FLOOD PROTECTION STUDY FEASIBILITY PHASE STUDY COST ESTIMATE SUMMARY

	COST OF FEDERAL <u>SERVICES</u>
1. Public Contact and Involvement	\$ 8,000
2. Hydrology Studies	\$ 25,000
3. Survey & Mapping	\$ 17,500
4. Materials Investigations	\$ 2,500
5. Design and Cost Estimates	\$ 20,000
6. Economic Studies	\$ 30,000
7. Environmental Studies	\$ 20,500
8. USF&WS Coordination	\$ 8,000
9. Study Management	\$ 22,000
10. Report Preparation	\$ 22,500
11. Institutional Analysis	-----
12. Audit	\$ 1,000
13. Archaeology	\$ 4,500
14. Real Estate	\$ 8,500
15. Review Contingency	\$ 10,000
	<hr/>
TOTAL	\$200,000

## APPENDIX C

### NANTASKET BEACH COASTAL FLOOD PROTECTION STUDY

#### FEASIBILITY PHASE STUDY COST SHARING

The cost of all study efforts are estimated to be \$200,000. Since the Federal Government and the non-Federal sponsor are required to share equally in the cost of the feasibility phase of the study it is necessary that the local sponsor, in this case the Commonwealth of Massachusetts, make a cash contribution of \$100,000 in order to make each partner's contribution equal to the other. This cost sharing is detailed below.

	<u>Services</u> <u>U.S. Dollars</u>	<u>Apportionment of costs</u> <u>U.S. Dollars</u>	<u>Percent</u>
Federal	\$ 100,000	\$100,000	50
Non-Federal	\$ 100,000	\$ 100,000	50
Total	\$200,000	\$200,000	100

SECTION III

APPENDICES

APPENDIX A

ENVIRONMENTAL RECONNAISSANCE REPORT

NANTASKET BEACH SHORELINE PROTECTION  
HULL, MASSACHUSETTS

ENVIRONMENTAL RECONNAISSANCE REPORT

PREPARED BY:

JAY MACKAY  
MARINE ECOLOGIST

U.S ARMY CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS

MARCH 1993



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## I. Project History and Description.

In March of 1968, a beach erosion control report for Nantasket Beach was issued in cooperation with the Metropolitan District Commission (MDC). This report recommended that a beach erosion control project be adopted that provides for beach widening by direct placement of suitable sand fill along about 6800 feet of beach fronting the MDC Reservation to a general backshore elevation 17 feet above mean low water which would furnish a recreational and protective beach averaging 190 feet in width behind the mean high water line (See Attachment). The project was subsequently authorized by Congress in December 1970. However, the project was never constructed and was subsequently de-authorized in January 1990.

The 30-31 October 1991 storm caused extensive damage to the rip-rap, sea walls, sidewalks, stairs and ramps along the MDC Reservation at Nantasket Beach. As a result of damages sustained during the storm, the MDC, in a letter dated January 6, 1992, asked the Army Corps of Engineers to reactivate the previously authorized project. Due to the critical nature of this situation it was decided to conduct this Reconnaissance Study under the authority contained in Section 103 of the 1946 Flood Control Act, as amended, that is administered under the Corps Continuing Authorities Program.

## II. Alternatives

A number of alternatives, both structural and non-structural, to reduce shore damage and flooding and the vulnerability of this area to flooding are being evaluated and include the following:

### ALTERNATIVE/SHORE/FLOOD DAMAGE PREVENTION MEASURES

#### MODIFYING SHORE DAMAGE/FLOODING

Offshore Breakwater  
Revetments  
Beach Fill  
Groins

#### Reduce Vulnerability

Floodproofing  
Flood Insurance  
Flood Warning and Evaluation

For the purposes of this reconnaissance study, the alternative of beach fill in conjunction with the repair and the replacement of the existing seawall, where necessary, will be assumed to be the preferred project plan. Upon review of the above options, it appears to represent the most acceptable and realistic plan from an engineering, environmental and economical standpoint and therefore will be the most likely to be implemented.

This plan of improvement calls for the placement of clean sand fill material along approximately 6,800 feet of Nantasket Beach fronting the MDC Reservation to a general backshore elevation of 17 feet above mean low water. Starting at the seawall the project would provide a 75 foot wide level beach berm, from here the beach face would then slope seaward with a slope of 1 vertical (V) to 15 horizontal (H) until it intersects the existing ground. This would then provide a protective beach averaging 190 feet in width behind the mean high water line.

The other alternative plans (i.e. offshore breakwaters, revetments and groins) are all considered "hard" solutions to the existing problem and would not likely be viewed as environmentally acceptable alternatives by the Massachusetts Coastal Zone Management Office and other state agencies. Additionally, it has been determined that groin structures would not alleviate present conditions given the fact that sediment transport is in the on-shore / offshore direction as opposed to longshore. The offshore breakwater and revetment plan were also found not to be economically justified.

### III. Initial Coordination

The following agencies were contacted during the development of this report (See Attached Correspondence) and will continue to be coordinated with as the study progresses:

- U.S. Environmental Protection Agency, Region I
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- Massachusetts Coastal Zone Management Office
- Massachusetts Division of Marine Fisheries
- Massachusetts Department of Environmental Protection
- Massachusetts Division of Water Pollution Control
- Massachusetts Office of Waterways
- Massachusetts Department of Environmental Management
- Executive Office of Environmental Affairs
- Massachusetts Division of Fisheries and Wildlife

An interagency site visit was conducted on March 4, 1993 to discuss the acceptability of each of the above alternatives and to receive recommendations by interested regulatory agencies.

### IV. Environmental Setting

The Nantasket Beach study area lies in the town of Hull, Plymouth County, Massachusetts. The study area is part of an elongated spit extending along a NW-SE axis into Massachusetts Bay running from the southern limit to the northern limit of the MDC Reservation. This beach lies directly on the Atlantic Ocean facing in a northeasterly direction. As a result, swells from ocean storms directly affect this section of coast and is the source of the coastal erosion which is currently being experienced. This area is designated as a public beach according to the Massachusetts Coastal Zone Management Plan (CZM 1977). It is primarily sand and stone cobble which runs the length of the project area and grades seaward producing an intertidal sand flat.

Over the years, this beach system has experienced sand migration away from the shoreline and intertidal areas to the offshore waters, resulting in an undermining of the existing seawall system which runs along the backshore, resulting in the recent total collapse of some sections. No dunes or seagrasses were observed in the project area during the most recent site visit.

## V. Environmental Resources

As a result of the lack of sand in the backshore area, the upper beach areas are currently unstable and are mostly underwater during the higher portions of the tidal cycle. These shifting sands provide little, if any, suitable substrate for biota to colonize. No dunes or seagrasses or significant environmental resources were observed within the intertidal area during a cursory site inspection. However, no formal biological sampling program has yet been carried out.

Numerous fragments of surf clams (Spisula solidissima) were observed within the beach area. Initial coordination (CZM, NMFS, various pers. comm.) has revealed that subtidally, a commercially harvestable surf clam population exists in the minus three (-3) to minus ten (-10) meter isopleth. Lobsters (Homarus americanus) are also harvested in the offshore waters.

Environmental concerns as they relate to project implementation would lie with the potential for impact to the commercially harvestable populations of the surf clam and lobsters as outlined above. Prior to project construction and in preparation of the Environmental Assessment, it will be necessary to quantify, through a formal sampling program, the existing benthic and shellfish resources that may inhabit the area. Should sufficient numbers of these individuals be at risk, a relocation plan may be implemented which would temporarily remove existing resources to unaffected areas and then allow repopulation of the stabilized area upon completion of the work.

## VI. Threatened and Endangered Species

Initial correspondence with the U.S. Fish and Wildlife Service and National Marine Fisheries Service has indicated that no Federally listed or proposed threatened and endangered species are known to exist within the study area.

## VIII. Archaeological and Historic Resources

### General

The town of Hull, Massachusetts, originally called Nantasket by the Wampanoag Indians, dates from 1644, when the town was named for a seaport town in Yorkshire, England. It is now known as Nantasket, but its official name is Hull (Bergan 1972:18).

Known originally as a fishing and agricultural town, in the late 19th Century and the area of the big hotel, Hull entered its golden era. From the early 1880's to the first world war, these palatial inns and resorts transformed the town into a popular summer resort on the eastern seaboard. During World War I, however, the growth of the automobile had a destructive effect on the hotels, steamboats, and trolleys which served the area. Most of the inns and hotels from this area are now gone (ibid, 18,24,65).

Beginning at about the same time as the rise of the hotel industry, the rise of cottages, primarily as vacation homes, began to predominate the town (Sweetser 1888:76-77). These homes ranging in size from a bungalow to mansion, are the late 19th and 20th Century historic homes which dot the vicinity of the project area.

The Metropolitan District Commission (MDC), formerly known as the Metropolitan Parks Commission, took control of some amusements in town, including Nantasket Beach in 1899 (Bergan 1972:72), and has controlled the popular beach resort since that time.

### Impacts

The proposed beach erosion control project for Nantasket Beach could possibly impact prehistoric or underwater archaeological resources, which may be in the vicinity of the project area. There are approximately twenty-seven (27) documented shipwrecks that may be located in the vicinity, as well as, at least eight (8) prehistoric archaeological sites which are known within the Hull area. Floodproofing measures which may be performed on historic homes near the proposed project area, could also impact significant resources. However, this is a preliminary investigation, and if this project proceeds to a further stage in the planning process, then formal comments will be requested from the Massachusetts State Historical Preservation Officer to satisfy Section 106 of the National Historic Preservation Act of 1966, as amended. The Massachusetts State Historic Preservation Officer, in a letter dated November 27, 1992, has concurred with these determinations.

### IX. Requirements for Feasibility Level Study

Environmental sampling and testing will be required, including sampling to characterize the benthic and shellfish communities on the beach and in any intertidal and offshore project areas. Other related and necessary environmental efforts would be directed toward interagency coordination, preparation of an Environmental Assessment and a Clean Water Act Section 404(b)1 Evaluation, as well as obtaining a Water Quality Certificate and a Coastal Zone Management Consistency Concurrence. Cumulative impacts analysis will need to assess the frequency and quantity of maintenance renourishment to assure sustainability of this project. The local sponsor will be required to obtain all local permits and Order of Conditions as well as a MEPA Certificate along with any applicable state permits.

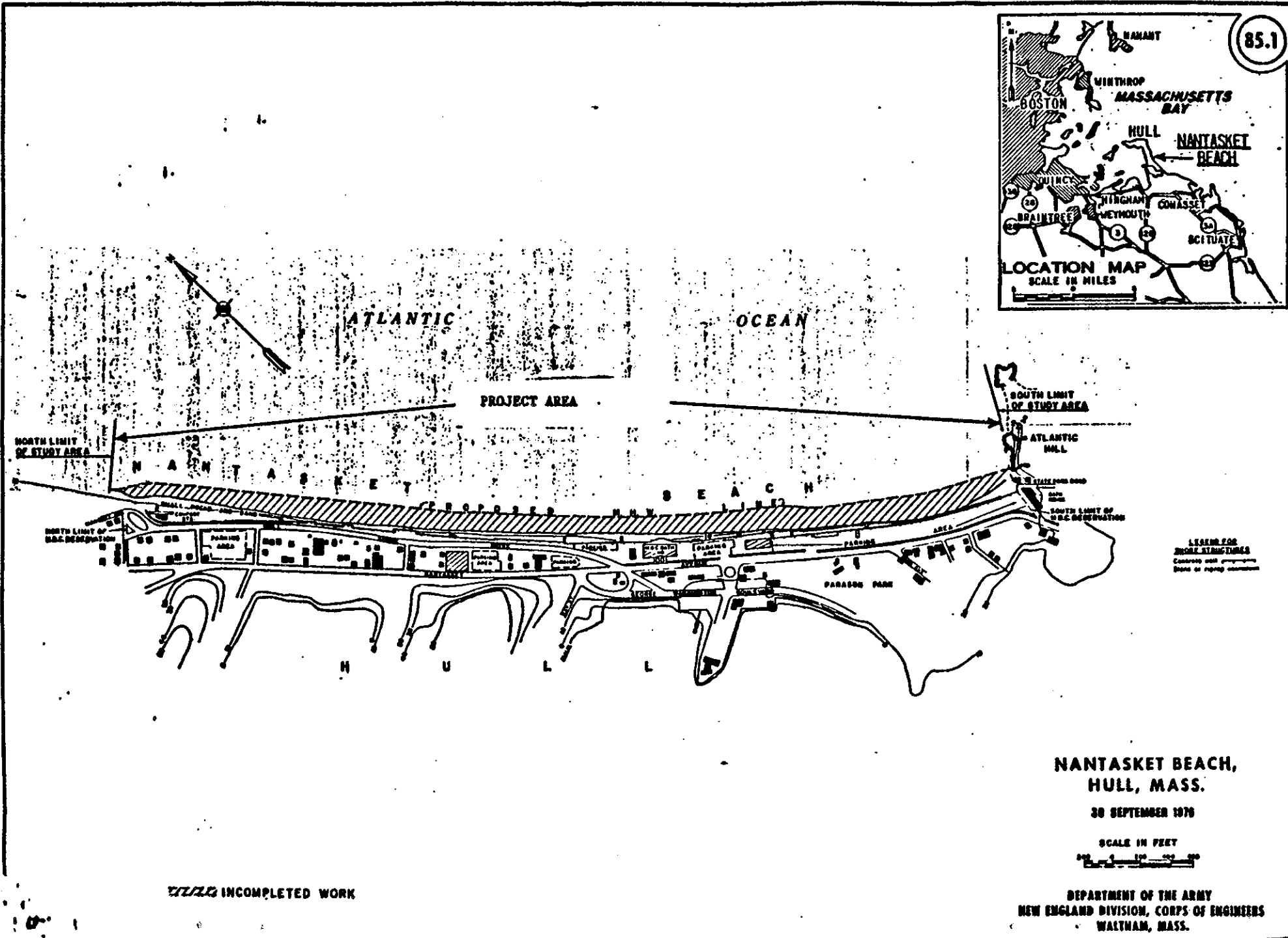
## X. References

Bergan, Doctor William M., 1972, Old Nantasket. The Christopher Publishing Company, North Quincy, Massachusetts.

Sweetser, M.F., 1888, King's Handbook of Boston Harbor. Moses King Corporation, Boston, Massachusetts.

Hubbard, William A. USACOE 1987. A Preliminary Reconnaissance Report for the Proposed Backshore Protection Project at Nantasket Beach in Hull, Massachusetts.

USACOE, 1988. Reconnaissance Report. North Nantasket Beach Shore Protection Study, Hull, Massachusetts.



PERTINENT CORRESPONDENCE



INCOMING



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02254-9149

October 23, 1992

RECEIVED

OCT 28 1992

Planning Directorate  
Impact Analysis Division

MASS. HIST. COMM.

SUBJECT: Section 205 (Local Flood Protection) Reconnaissance Study of  
Nantasket Beach, Hull, Massachusetts

Ms. Judith McDonough - Executive Director  
Massachusetts Historical Commission  
80 Boylston Street  
Boston, Massachusetts 02116

Dear Ms. McDonough:

The Army Corps of Engineers, New England Division (NED), is preparing a reconnaissance study for proposed Section 205 (Local Flood Protection) activities on Nantasket Beach in Hull, Massachusetts (see location map). The following information is being provided for your preliminary comments.

In March of 1968, a beach erosion control report for Nantasket Beach was issued in cooperation with the Metropolitan District Commission (MDC). This report recommended that a beach erosion control project be adopted that provides for beach widening by direct placement of suitable sandfill along about 6,800 feet of beach fronting the MDC Reservation to a general backshore elevation 17 feet above mean low water, thus furnishing a recreational and protective beach averaging 190 feet in width behind the mean high water line (see attached map). The project was subsequently authorized by Congress in December 1970. However, the project was never constructed and was subsequently de-authorized in January 1990.

The 30-31 October 1991 storm caused extensive damage to the rip rap, sea walls, sidewalks, stairs, and ramps along the MDC Reservation at Nantasket Beach. As a result of the damages sustained during this storm, the MDC, in a letter dated 6 January 1992, asked NED to reactivate the previously authorized project (see attached letter). Due to the critical nature of the situation it has been decided to conduct a Reconnaissance Study under the authority contained in Section 205 of the 1946 Flood Control Act, as amended, that is administered under the Corps Continuing Authorities Program.

The reconnaissance study will consider both structural and nonstructural measures to reduce flooding and the vulnerability of the area to flooding. These include the following:

Flood Reduction Measures

Offshore Breakwater  
Sea Wall Modifications  
Revetments  
Beach Fill  
Groins

Reduction of Vulnerability

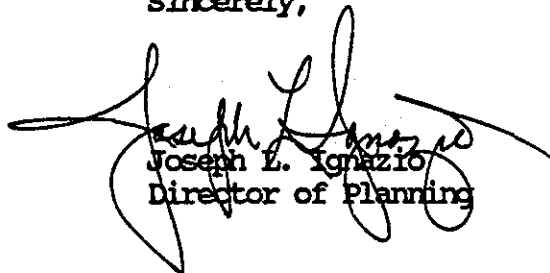
Floodproofing  
Flood Warning and Evaluation  
Flood Insurance

A review of NED's shipwreck files indicate that approximately twenty-seven (27) documented shipwrecks may be located in the vicinity of the project area. In addition, at least eight (8) prehistoric sites are known within the Hull area. Historic houses which are in the vicinity of the project area could be impacted by possible floodproofing measures.


However, this is a preliminary investigation. If this project proceeds to a further stage in planning, then a detailed flood protection plan will be selected. At that time, the final plan will be evaluated for its effect upon historic properties. We would appreciate your preliminary comments on the proposed project. If this project does proceed to a further planning phase, then formal comments will be requested to satisfy Section 106 of the National Historic Preservation Act of 1966, as amended.

If you have any questions, please feel free to contact Mr. Marc Paiva of the Impact Analysis Division at (617) 647-8796.

Sincerely,

  
Joseph L. Ignazio  
Director of Planning

Enclosures

CONCURRENCE:   
JUDITH B. McDONOUGH  
EXECUTIVE DIRECTOR  
STATE HISTORIC  
PRESERVATION OFFICER  
MASSACHUSETTS  
HISTORICAL COMMISSION 11/27/92



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

New England Field Offices  
400 Ralph Pill Marketplace  
22 Bridge Street, Unit #1  
Concord, New Hampshire 03301-4901

March 16, 1993

Joseph Ignazio  
Planning Division  
Army Corps of Engineers  
424 Trapelo Road  
Waltham, Massachusetts 02254-9149

Dear Mr. Ignazio:

This responds to your letter dated February 11, 1993 requesting information on the presence of Federally listed and proposed endangered or threatened species in relation to the proposed Section 205 activities on Nantasket Beach in Hull, Massachusetts.

Based on information currently available to us, no Federally listed or proposed threatened and endangered species under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area, with the exception of occasional transient endangered bald eagles (Haliaeetus leucocephalus) or peregrine falcons (Falco peregrinus anatum). However, we suggest that you contact Pat Huckery of the Massachusetts Natural Heritage Program, Division of Fisheries and Wildlife at 100 Cambridge St., Boston, MA 02202, (617) 727-9194 for information on state listed species that may be present.

Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required. Should project plans change, or additional information on listed or proposed species becomes available, this determination may be reconsidered. This response relates only to endangered species under our jurisdiction. It does not address other legislation or our responsibilities under the Fish and Wildlife Coordination Act and the Federal Power Act.

Thank you for your cooperation and please contact Susi von Oettingen of this office at (603) 225-1411 if we can be of further assistance.

Sincerely yours,

Gordon E. Beckett  
Supervisor  
New England Field Offices

OUTGOING

February 11, 1993

Planning Division  
Impact Analysis Branch

Mr. Gordon E. Beckett, Supervisor  
U.S. Department of the Interior  
Fish and Wildlife Service  
Ecological Services  
22 Bridge Street, Ralph Pill Bldg., 4th Floor  
Concord, New Hampshire 03301

Dear Mr. Beckett:

The U.S. Army Corps of Engineers, New England Division (NED), is preparing a reconnaissance study for proposed Section 205 (Local Flood Protection) activities on Nantasket Beach in Hull, Massachusetts. The purpose of this letter is to obtain your preliminary comments on this project pursuant to the Fish and Wildlife Coordination Act as amended, and to request a list of threatened and endangered species for the project area, pursuant to Section 7(c) of the Endangered Species Act of 1973 as amended. Enclosed is a location map of the area to aid you in your work.

In March of 1968, a beach erosion control report for Nantasket Beach was issued in cooperation with the Metropolitan District Commission (MDC). This report recommended that a beach erosion control project be adopted that provides for beach widening by direct placement of suitable sand fill along about 6,800 feet of beach fronting the MDC Reservation to a general backshore elevation 17 feet above mean low water, thus furnishing a recreational and protective beach averaging 190 feet in width behind the mean high water line (see attached map). The project was subsequently authorized by Congress in December 1970. However, the project was never constructed and was subsequently de-authorized in January 1990.

The October 30-31, 1991 storm caused extensive damage to the rip-rap, sea walls, sidewalks, stairs and ramps along the MDC Reservation at Nantasket Beach. As a result of the damages sustained during this storm, the MDC, in a letter dated January 6, 1992, asked NED to reactivate the previously authorized project. Due to the critical nature of the situation it has been decided to conduct a Reconnaissance Study under the authority contained in Section 205 of the 1946 Flood Control Act, as amended, that is administered under the Corps continuing Authorities Program.

The reconnaissance study will consider both structural and non-structural measures to reduce flooding and the vulnerability of the area to flooding. These include the following:

Flood Reduction Measures

Offshore Breakwater  
Sea Wall Modifications  
Revetments  
Beach Fill  
Groins

Reduction of Vulnerability

Floodproofing  
Flood Warning Evaluation  
Flood Insurance

An interagency site visit will be conducted on Thursday, March 4, 1993 at 11:00 a.m. to review the various alternatives and obtain your comments.

If you require any further information about the proposed project, please contact Mr. Jay Mackay, Marine Ecologist at the Environmental Resources Branch at (617) 647-8142

Sincerely,

Joseph L. Ignazio  
Director of Planning

Enclosure

February 11, 1993

Planning Division  
Impact Analysis Branch

Mr. Jay Copeland  
Mass. Division of Fisheries and Wildlife  
100 Cambridge Street  
Boston, MA 02202

Dear Mr. Copeland:

The U.S. Army Corps of Engineers, New England Division (NED), is preparing a reconnaissance study for proposed Section 205 (Local Flood Protection) activities on Nantasket Beach in Hull, Massachusetts. The purpose of this letter is to obtain your preliminary comments on this project pursuant to the Fish and Wildlife Coordination Act as amended, and to request a list of State Species of Concern. Enclosed is a location map of the area to aid you in your work.

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Sincerely,

Joseph L. Ignazio  
Director of Planning

Enclosure

February 11, 1993

Planning Division  
Impact Analysis Branch

Mr. Douglas Beach  
NOAA - Fisheries  
Habitat Conservation Office  
One Blackburn Drive  
Gloucester, Massachusetts 01930-2298

Dear Mr. Beach:

The U.S. Army Corps of Engineers, New England Division (NED), is preparing a reconnaissance study for proposed Section 205 (Local Flood Protection) activities on Nantasket Beach in Hull, Massachusetts. The purpose of this letter is to obtain your preliminary comments on this project pursuant to the Fish and Wildlife Coordination Act as amended, and to request a list of threatened and endangered species for the project area, pursuant to Section 7(c) of the Endangered Species Act of 1973 as amended. Enclosed is a location map of the area to aid you in your work.

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An interagency site visit will be conducted on Thursday, March 4, 1993 at 11:00 a.m. to review the various alternatives and obtain your comments.

If you require any further information about the proposed project please contact Mr. Jay Mackay, Marine Ecologist at the Environmental Resources Branch at (617) 647-8142

Sincerely,

Joseph L. Ignazio  
Director of Planning

Enclosure

February 11, 1993

Planning Division  
Impact Analysis Branch

SEE SAME LETTER SENT TO "ATTACHMENT  
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Dear n :

The U.S. Army Corps of Engineers, New England Division (NED), is preparing a reconnaissance study for proposed Section 205 (Local Flood Protection) activities on Nantasket Beach in Hull, Massachusetts. The purpose of this letter is to obtain your preliminary comments on this project which will be utilized in the generation of the report. Enclosed is a location map of the area to aid you in your work.

In March of 1968, a beach erosion control report for Nantasket Beach was issued in cooperation with the Metropolitan District Commission (MDC). This report recommended that a beach erosion control project be adopted that provides for beach widening by direct placement of suitable sand fill along about 6,800 feet of beach fronting the MDC Reservation to a general backshore elevation 17 feet above mean low water, thus furnishing a recreational and protective beach averaging 190 feet in width behind the mean high water line (see attached map). The project was subsequently authorized by Congress in December, 1990. However, the project was never constructed and was subsequently de-authorized in January 1990.

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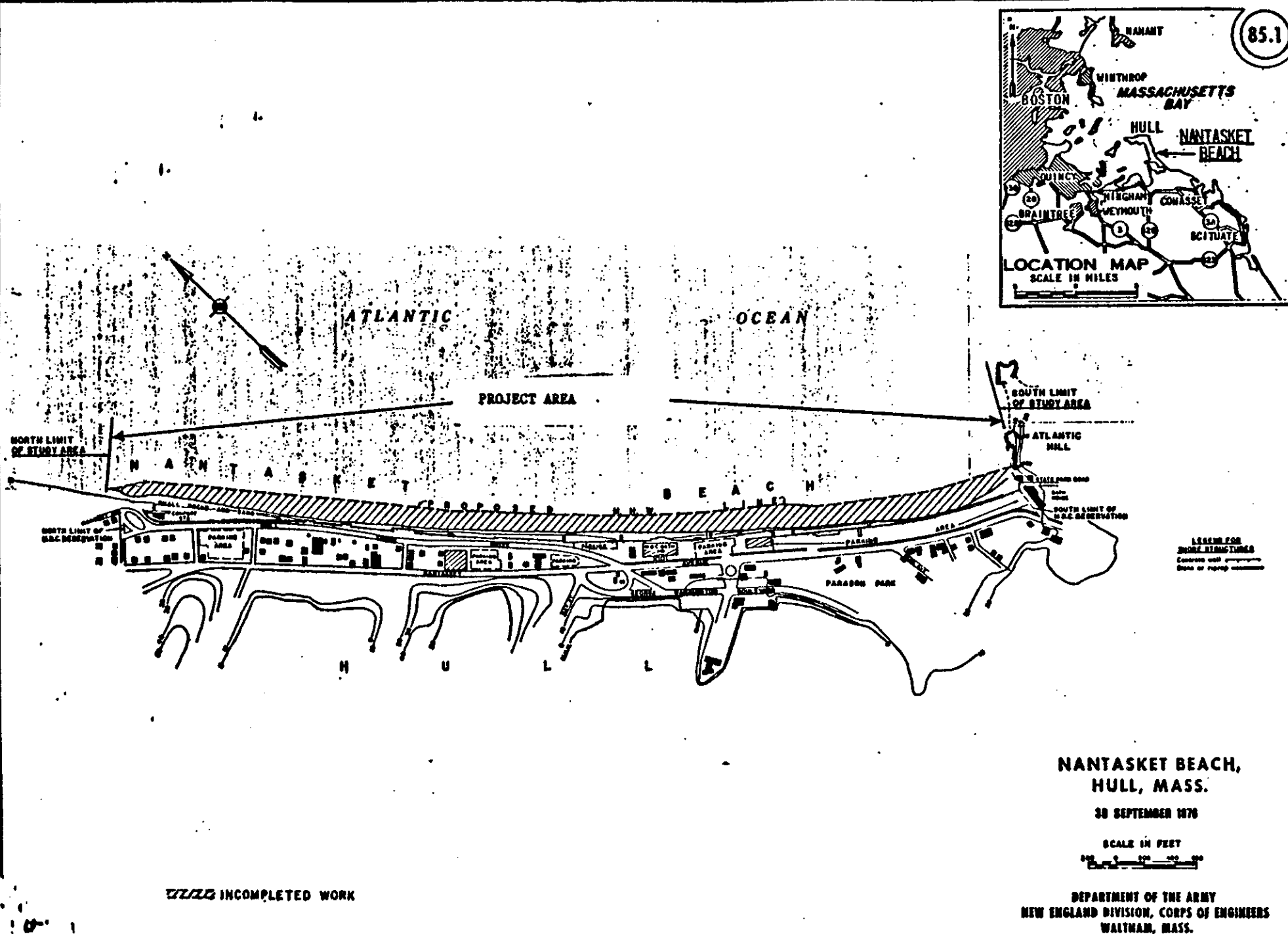
An interagency site visit will be conducted on Thursday, March 4, 1993 at 11:00 a.m. to review the various alternatives and obtain your comments.

If you require any further information about the proposed project please contact Mr. Jay Mackay, Marine Ecologist at the Environmental Resources Branch at (617) 647-8142

Sincerely,

Joseph L. Ignazio  
Director of Planning

Enclosure



**SAME LETTER SENT TO:**

**Mr. Phillip G. Coates, Director**  
**MA Division of Marine Fisheries**  
**100 Cambridge Street**  
**Boston, Massachusetts 02202**

**Mr. Brian Donahoe, Director**  
**Department of Environmental Protection**  
**Division of Water Pollution Control**  
**One Winter Street**  
**Boston, Massachusetts 02108**

**Ms. Judy Perry**  
**Division of Water Pollution Control**  
**One Winter Street**  
**Boston, Massachusetts 02108**

**Ms. Christy Foote-Smith**  
**Massachusetts Department of Environmental Protection**  
**Division of Wetlands and Waterways Regulation**  
**One Winter Street**  
**Boston, Massachusetts 02108**

**Mr. Douglas Thompson**  
**Chief, Wetlands Protection Section**  
**U.S. Environmental Protection Agency**  
**JFK Federal Building., Region I**  
**Government Center**  
**Boston, Massachusetts 02203**

**Mr. Jeffery Benoit**  
**Massachusetts Coastal Zone Management**  
**100 Cambridge Street**  
**Boston, Massachusetts 02202**

**Ms Jane Meade**  
**Project Review Coordinator**  
**Massachusetts Coastal Zone Management**  
**100 Cambridge Street**  
**Boston, Massachusetts 02202**

**Mr. Eugene Cavanaugh**  
**Massachusetts Department of Environmental Management**  
**Bureau of Coastal Engineering**  
**100 Cambridge Street**  
**14th Floor**  
**Boston, Massachusetts**

**Mr. Leslie Lewis** ✓  
**Massachusetts Department of Environmental Management**  
**Bureau of Coastal Engineering**  
**100 Cambridge Street**  
**14th Floor**  
**Boston, Massachusetts**

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Mr. Daniel Greenbaum, Commissioner  
Massachusetts Department of Environmental Protection  
One Winter Street  
Boston, Massachusetts 02108

Mr. Charles Yelen  
Chief of Staff  
Executive Office of Environmental Affairs  
One Ashburton Place, Room 2101  
Boston, Massachusetts 02108

Mr. Douglas Beach  
NOAA-Fisheries  
Habitat Conservation Office  
One Blackburn Drive  
Gloucester, Massachusetts 01931-2298

Mr. Gordon E. Beckett  
U.S. Department of the Interior  
Fish and Wildlife Service  
Ecological Services  
22 Bridge Street., Ralph Pill Bldg., 4th Floor  
Concord, New Hampshire 03301

Mr. Jay Copeland  
Massachusetts Division of Fisheries and Wildlife  
Natural Heritage and Endangered Species Program  
100 Cambridge Street  
Boston, Massachusetts 02202